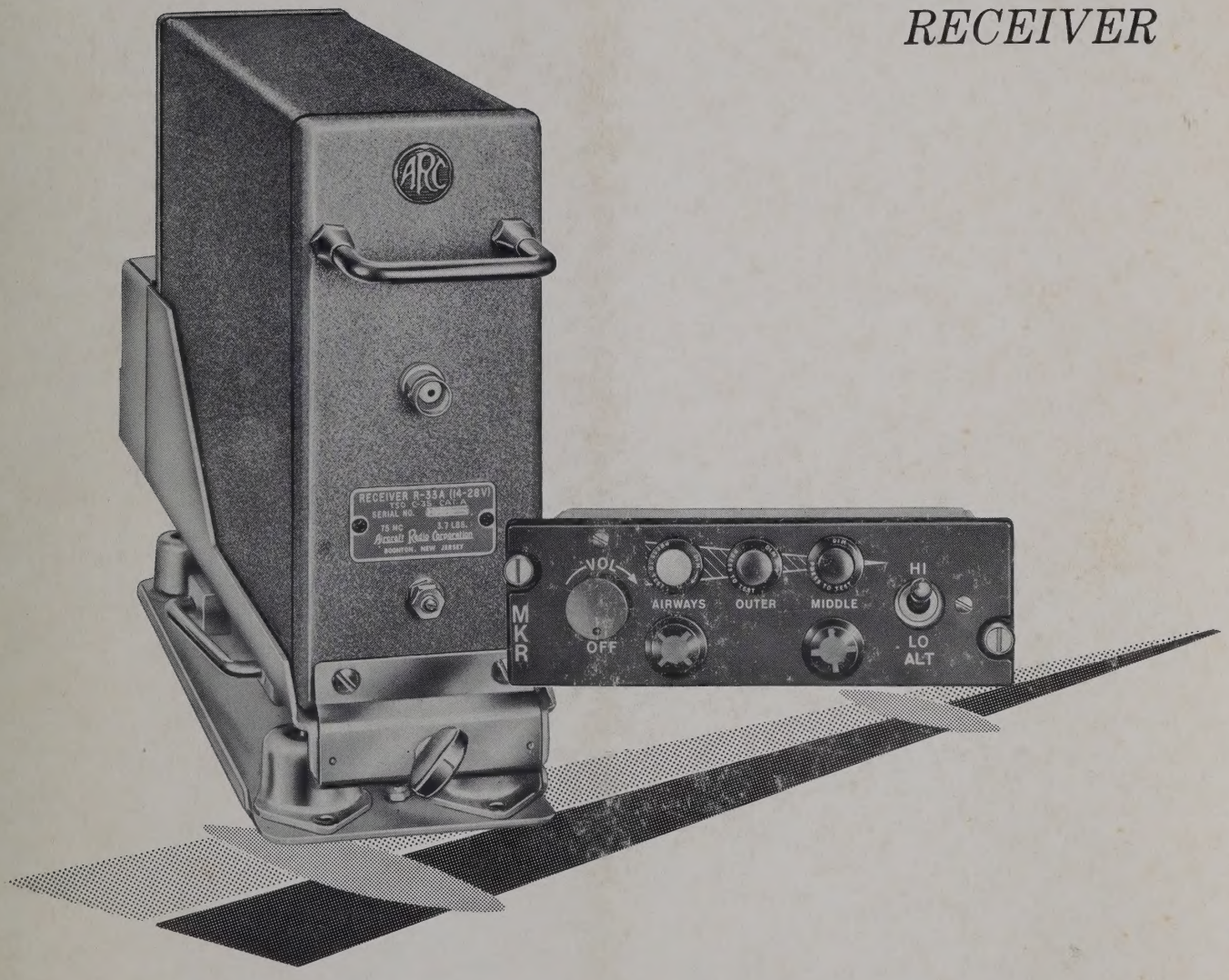
GREAT LAKES AIRMOTIVE, INC.
Willow Run Airport
(HUnter 2-2621 or LO 5-4303)
Ypsilanti, Michigan

ARC TYPE
R-33A
MARKER BEACON RECEIVER



ARC
Aircraft Radio Corporation
BOONTON, NEW JERSEY

ARC TYPE
R-33A
MARKER BEACON RECEIVER

Aircraft Radio Corporation
BOONTON, NEW JERSEY

7010130
ARCIB-R33A-2B
March 1961, Rev. 7/64
Printed in U.S.A.

WARRANTY

Aircraft Radio Corporation warrants each new airborne product to be free of defects in workmanship and material for a period of twelve months from date of original installation. A defective product will be replaced or repaired (at ARC discretion) when returned to ARC, transportation prepaid, by an ARC authorized dealer or service agency. A statement establishing the date of installation must also accompany the defective unit.

Aircraft Radio Corporation will reimburse an ARC authorized dealer or service agency for labor charges and parts replacement incurred in the repair of defective products for a period of ninety days from date of original installation. Request for payment (or credit) must be made by an authorized ARC dealer or service agency on an ARC supplied form, number 1888A (Warranty Service Report and Invoice). Such charges shall be billed at the authorized dealer or service agency normal shop labor rates.

This warranty shall not apply to any ARC product which, in the judgment of ARC, has been repaired or altered in any way so as adversely to affect its performance or reliability or has been subject to misuse, negligence or accident. This warranty is in lieu of all other guarantees or warranties expressed or implied. The obligation and responsibility of ARC for or with respect to defective equipment shall be limited to that expressly provided herein and ARC shall not be liable for consequential or other damage or expense whatsoever therefor or by reason thereof.

ARC reserves the right to make changes in design or additions to or improvements in its equipment without obligation to make such changes or to install such additions or improvements in equipment theretofore manufactured.

ARC will make available repair components when requested by the authorized ARC dealer, using Form 1888A for these requisitions.

The information in this instruction book does not profess to include all the details of design, production, or variations of the equipment, or to cover all the possible contingencies which may arise during operation, installation, or maintenance. Should special problems arise or further information be desired, contact the Technical Services Department of Aircraft Radio Corporation.

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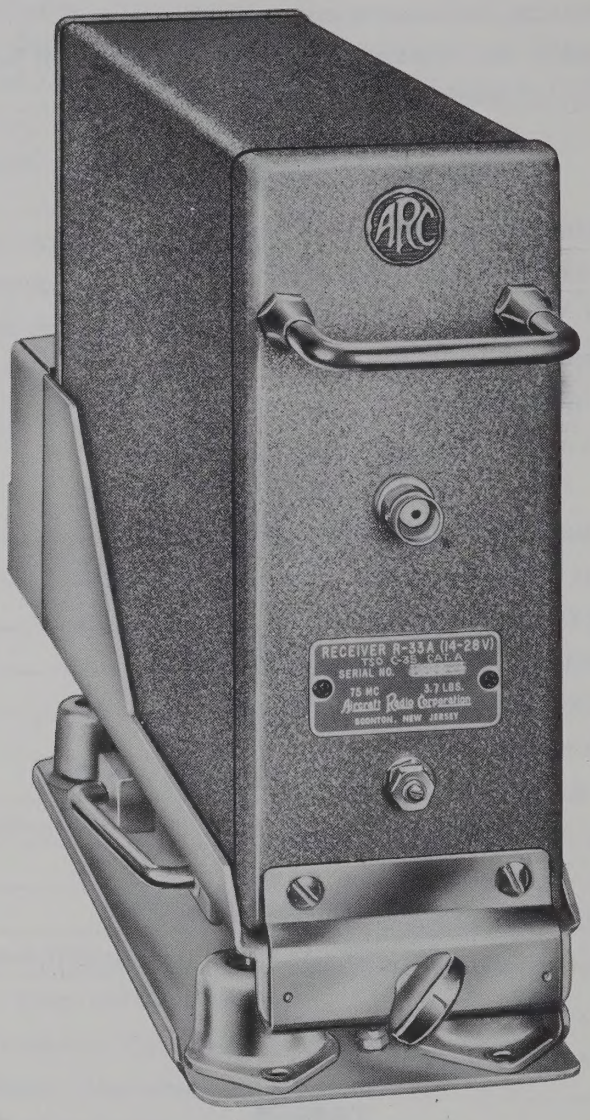

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Figure 1–1. ARC Type R-33A Receiver with ARC Type M-41B Mounting

SECTION I
GENERAL INFORMATION

1–1. INTRODUCTION.

This instruction book contains installation, operation, principles of operation, and maintenance information for the ARC Type R-33A Marker Beacon Receiver.

1–2. PURPOSE.

The ARC Type R-33A Receiver is an all-transistor, dual-sensitivity, three-light marker beacon receiver that provides visual and aural indications of 75-megacycle airway and ILS marker beacon signals, amplitude-modulated with 400-, 1300-, or 3000-cps tones.

1–3. SPECIFICATIONS.

Frequency:	75 mc, fixed-tuned
Circuit:	Double-conversion superheterodyne
R-f Input:	52 ohms
Sensitivity Control:	Two positions (HI-LO), both adjustable
Maximum Sensitivity:	200 hard microvolts in HI position of sensitivity switch
Selectivity:	±40 kc for 6-db down position ±190 kc for 60-db down position
Intermediate Frequencies:	First i-f, 11.5 mc Second i-f, 1.7 mc
Spurious Rejection:	At least 68 db
Agc:	Within 6 db, 200-250,000 hard microvolts
Indications:	Aural and three-light visual
Audio Output:	200 milliwatts into 300-ohm load
Total Harmonic Distortion:	Less than 25%
Input Current:	Approximately 0.375 ampere at 27.5 or 13.75 volts dc (at no signal condition)
Mounting:	ARC Type M-41B Mounting for single-unit installation, or other ARC Series 40 Mounting for multiple-unit installation
Weight:	3.7 pounds, less mounting 5.1 pounds, including M-41B Mounting
Dimensions:	3 7/32 in. wide, 7½ in. high, 14¼ in. long, over-all, including M-41B Mounting
Certification:	FAA TSO C-35, Category A

1–4. EQUIPMENT SUPPLIED.

The units and accessories supplied for an R-33A installation are listed in Table 1–1. The R-33A Receiver and an M-41B Mounting are shown in Figure 1–1.

TABLE 1–1. EQUIPMENT SUPPLIED

Qty	Name	ARC Part No.
1	ARC Type R-33A Receiver	21430
1	Connector Kit consisting of:	22424
1	Connector	21766
1	Plate	22423
6	Sems, fillister head, No. 4-40, ¼ inch long, split lockwasher	524-0016
2	Screw, machine, flat head, No. 6-32, 5/16 inch long	146-0020
2	Stud, snapslide	22237
20 ft	Cable, coaxial (RG-58/U)	11318
2	Connector, coaxial (UG-88C/U)	11337
1	Connector, coaxial (UG-290A/U)	11338
1	Instruction Book	7010130

1–5. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

Table 1–2 lists the equipment required, but not supplied, for installation and operation of the R-33A Receiver. In addition to the items listed, an interconnecting cable assembly, fabricated from individual wires (not supplied) and the connector kit listed in Table 1–1, is required. The R-33A requires a primary power source capable of supplying 0.375 ampere at 27.5 or 13.75 volts dc.

TABLE 1–2. EQUIPMENT REQUIRED BUT NOT SUPPLIED

Qty	Name	ARC Part No.
1	Antenna ARC Type A-24A[1]	24810
1	Control Unit ARC Type C-83A[2]	22360
1	Headset, 600 ohms	11935
1	Mounting, ARC Series 40[3]	—

[1] In place of the A-24A, an inverted-T wire antenna may be used (see Figure 2–5).

[2] The C-83A is furnished with 28-volt pilot lamps installed and with 14-volt lamps as accessories. In place of the C-83A, a custom control installation consisting of three indicating lights, a high-low sensitivity switch, a power on-off switch, and, if desired, a volume control may be used.

[3] For single-unit installation, use an ARC Type M-41B Mounting (ARC-23740).

1–6. DESCRIPTION.

The ARC Type R-33A Receiver is an all-transistor marker beacon receiver. It provides aural and three-light visual indications when receiving 75-mc marker beacon signals amplitude-modulated at 400, 1300, or 3000 cps. The r-f sensitivity of the receiver can be internally adjusted to accommodate various types of antennas. An external sensitivity switch (not supplied) is used to select either of two r-f sensitivity levels, each of which is internally adjustable. The triggering level for each indicating light can also be adjusted internally.

The R-33A Receiver has an aural output of 200 mw into a 300-ohm load. This aural output level is controlled by a potentiometer on the front of the receiver and, if desired, by an external volume control.

Visual indications of marker beacon signals are provided by three lamps which are part of the ARC Type C-83A Control Unit. The receiver has one lamp output lead for each of the three marker beacon modulating frequencies: 400 cps for ILS outer markers (blue light), 1300 cps for ILS middle markers (amber light), and 3000 cps for Z markers and fan markers (white light). Each lamp receives power from the aircraft's primary d-c power source through a transistor switch in the receiver.

Modular construction is used for the R-33A Receiver. The chassis, enclosed by an aluminum dust cover, supports a printed-circuit board and seven plug-in assemblies. The components of each assembly are mounted on a printed-circuit board supported by an aluminum frame. These frames are, in turn, supported by the chassis. Jacks on one edge of each board make the necessary electrical connections with pins on the chassis printed-circuit board.

Except for the antenna, all electrical connections for the R-33A are made through a connector at the rear of the unit, which mates with a connector on the M-41B Mounting or other ARC Series 40 Mounting. The antenna is connected to a BNC connector mounted on the front panel of the receiver.

1–7. DESCRIPTION OF ASSOCIATED UNITS.

Mounting. The ARC Type M-41B Mounting, or other ARC Series 40 Mounting, is used to shock-mount the R-33A Receiver and to provide a means of making electrical connections to the unit. The R-33A is secured by a flange located at the front of the mounting. Two flexible metal straps, on the underside of the mounting, are used to ground the R-33A and M-41B to the airframe. Eight No. 6 screw holes are provided in the bottom plate of the M-41B for securing the mounting.

Note

If more than one R-33A is to be installed, or if an R-33A is to be installed with other ARC modular-type units, one of the multiple-unit ARC Series 40 Mountings may be used. For detailed information, refer to the instruction book for the ARC Series 40 Mountings.

C-83A Control Unit. The ARC Type C-83A Control Unit is an edge-lighted, plastic-panel control assembly designed for use in aircraft equipped with console mounting facilities. The C-83A contains a combination power on-off switch and volume control, three indicating lights, and a high-low sensitivity switch. Edge-lighting of the controls and panel designations is provided by two midget, flange-base lamps installed in red-filter light assemblies on the plastic panel. All electrical connections to the C-83A are made through a rear-mounted connector. The unit is secured by four Dzus fasteners on the front panel.

Note

In place of the C-83A Control Unit, a custom control installation duplicating the C-83A indicating lights and controls may be used.

A-24A Antenna. The ARC Type A-24A Antenna is a streamlined, 75-mc marker beacon antenna assembly designed to mount in any suitable location on the bottom of an aircraft. The antenna assembly consists of an end-loaded rod element completely enclosed in a streamlined, Fiberglas housing. The interior of the antenna assembly is filled with foam resin to prevent vibration of the rod element and to provide a weatherproof seal. Connection to the antenna is made through a BNC connector mounted on the antenna base.

Note

In place of an A-24A Antenna, an inverted-T wire antenna may be used (see Figure 2–5).

Accessories. The accessories for the R-33A Receiver consist of a connector kit, a 20-foot length of RG-58/U coaxial cable, two UG-88C/U coaxial connectors, and a UG-290A/U coaxial connector. The connector kit consists of the connector, which mates with the R-33A connector, and the necessary hardware for installing the connector on the R-33A mounting. The UG-88C/U coaxial connectors and the RG-58/U coaxial cable are used to fabricate the antenna leadin; the UG-290A/U coaxial receptacle is used only if an inverted-T wire antenna is installed.

SECTION II
INSTALLATION

2–1. UNPACKING.

Carefully unpack the R-33A and accessories. Inspect the shipment for damage, and check off the items received against the packing slip and the list of equipment supplied (Table 1–1).

2–2. CABLE FABRICATION.

The interconnecting cable harness for the R-33A and the C-83A or other control unit is fabricated from individual wires and the connectors supplied. An open-wire cable is recommended because of its flexibility, ease of construction, and facility for repair. The antenna cable assembly is fabricated from the length of RG-58/U coaxial cable and the two UG-88C/U connectors supplied. See Figures 2–6 and 2–7.

2–3. PREINSTALLATION TEST.

Before installing the R-33A Receiver, bench-test the unit for over-all performance as described in paragraph 5–4 and Table 5–2. The test equipment required is listed in Table 5–1 and the bench test setup is shown in Figure 5–1. Bench tests and adjustments should be made only by a qualified technician.

The R-33A Receiver is adjusted at the factory for high and low sensitivities of 1000 and 4000 hard microvolts, respectively. If other sensitivity settings are desired, adjust the sensitivity as described in the *Sensitivity Adjustment* procedure given in Table 5–4.

2–4. INSTALLATION REQUIREMENTS.

The following requirements are applicable to all installations of the R-33A.

Location of Units. Compare the proposed installation area with the applicable dimensions shown in Figures 2–1, 2–3, 2–4, and 2–5. Locate the R-33A in an area that is accessible for maintenance and inspection, and reasonably free from excessive vibration and heat. Mount the C-83A Control Unit or the custom control unit parts on the instrument panel within convenient view and reach of the operator.

Antenna. The R-33A requires a 50-ohm antenna. Either the ARC Type A-24A Antenna or an inverted-T, 75-mc, wire antenna may be used.

External Wiring. Figure 2–7 is an interconnection diagram of the external wiring required for the R-33A. Wires should be tied or laced and supported as required after interconnection. Sufficient slack should be left to allow removal of the R-33A for adjustment with wires connected. Assembly instructions for the antenna cable assembly are shown in Figure 2–6.

The R-33A is designed to operate on either 14 or 28 volts dc, depending on the external wiring connections as shown in Figure 2–7. Connection to the power source should be made through a 1-ampere circuit-protective device and a switch, located as desired.

2–5. INSTALLATION OF R-33A RECEIVER AND M-41B MOUNTING.

The ARC Type R-33A Receiver may be installed separately on an M-41B Mounting, as described in the following procedure, or with other ARC modular units on an ARC Series 40 multiple-unit mounting, as shown in the instruction book for the ARC Series 40 Mountings. To install the M-41B and the R-33A, proceed as follows:

Step 1. Use the bottom plate of the M-41B Mounting as a template to locate the mounting holes and drill the mounting surface as shown in Figure 2–1. The mounting surface should be clean, bare metal to insure proper grounding of the unit.

Step 2. Secure the M-41B Mounting with binding head screws, lockwashers, and nuts.

Step 3. Remove the coupling box from the rack and the top cover from the coupling box (see Figure 2–2).

Step 4. Attach Connector ARC-21766, in the normal-center (N2) position, to Plate ARC-22423, as shown in Figure 2–2.

Step 5. Cut the wires for the interconnecting cable assembly to the required lengths; use color-coded wires or tag both ends to simplify interconnection and future maintenance.

Step 6. Bare and tin the ends of the cut wires.

Step 7. Solder the wires to the contacts supplied with Connector Kit ARC-22424. Do not get solder on the outside of the contacts.

Note

Contacts for letter-designated holes are larger than the contacts intended for number-designated holes.
If desired, the connector may be used as a holding fixture by inserting the contact part way before soldering.

Step 8. Loosen the coupling box cable clamp. Route the contacts and the attached wires through the cable clamp. Insert the contacts in the appropriate connector holes (see Figure 2–7). Be sure each contact is seated.

Note

To remove a contact from the connector, use Contact Removing Tools ARC-22001 and ARC-22002.

Step 9. Arrange the wires, allowing enough slack to prevent tension on the connector contacts when the cable clamp is tightened, tighten the cable clamp, and replace the top cover on the coupling box.

Step 10. Attach two ARC-22237 snapslide studs on the coupling box as shown in Figure 2–2. Place the coupling box on the rear of the mounting. Secure the coupling box by engaging the two snapslide fasteners on the mounting with the snapslide studs on the coupling box.

Step 11. Loosen the thumbscrew on the front of the M-41B. Slide the R-33A onto the M-41B until their connectors are completely mated. Secure the R-33A by positioning the M-41B clamp and tightening the thumbscrew. Safety-wire the thumbscrew.

2–6. INSTALLATION OF CONTROL UNIT.

Installation dimensions for the C-83A Control Unit are shown in Figure 2–3. The C-83A is designed for installation on a standard AN console panel and is secured by four Dzus fasteners.

In place of the C-83A, a custom control installation may be made using three indicating lights, a high-low sensitivity switch, a power on-off switch, and, if desired, a volume control. For the indicating lights install three Type 327 (28 volts, .04 ampere) or Type 330 (14 volts, .08 ampere) midget, flange-base panel lamps, depending on the primary voltage. Two spst switches are used for the sensitivity and power controls. If a volume control is used, it may be combined with the power switch.

2–7. INSTALLATION OF ANTENNA.

The R-33A Receiver is designed for use with a 50-ohm antenna such as the A-24A Marker Beacon Antenna. Other antennas such as a 75-mc wire antenna may be used. Installation dimensions for the A-24A Antenna are

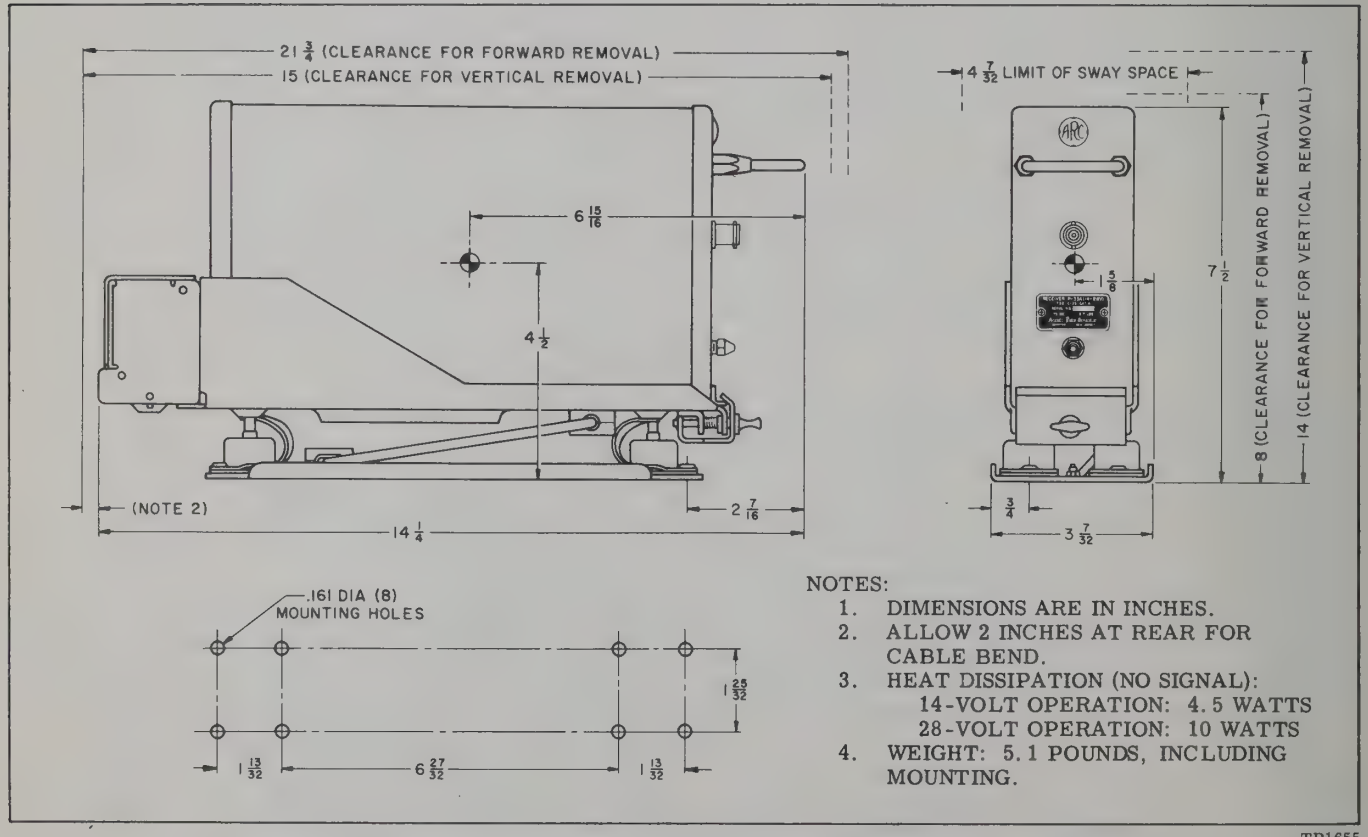

Figure 2–1. R-33A Receiver with M-41B Mounting, Installation Dimensions

shown in Figure 2–4. Installation dimensions for an inverted-T wire antenna are shown in Figure 2–5. The A-24A may be mounted in any convenient location on the bottom of the aircraft, with its long axis parallel to the fore-aft line and as close as possible to the centerline of the aircraft.

Caution

Never paint the housing of the A-24A Antenna. The unit is lifetime-protected with a coat of non-metallic paint.

2–8. OPERATIONAL CHECK.

An in-flight operational check should be made after installation and connection of the receiver. With the sensitivity switch in the LO position, fly over a standard Z marker at 1000 feet above the ground and at 120 mph ground speed. The white light should operate for from 12 to 15 seconds. At normal operating altitude and speed, observe the lamp on-time with the sensitivity switch in the HI position. (If adjustment of the sensitivity level is required, refer to paragraph 5–6.)

If an external volume control is installed, set in full-clockwise position and adjust the volume-level control on the R-33A front panel for the maximum audio level desired.

Caution

As shipped from the factory, the R-33A volume-level control is adjusted for a maximum audio output of 8.6 volts ac across 300 ohms (250 milliwatts) with an r-f input of 10,000 hard microvolts, 95% modulation at 1300 cps, high receiver sensitivity. *When adjusting the R-33A volume-level control, do not exceed this maximum setting or audio distortion will result.*

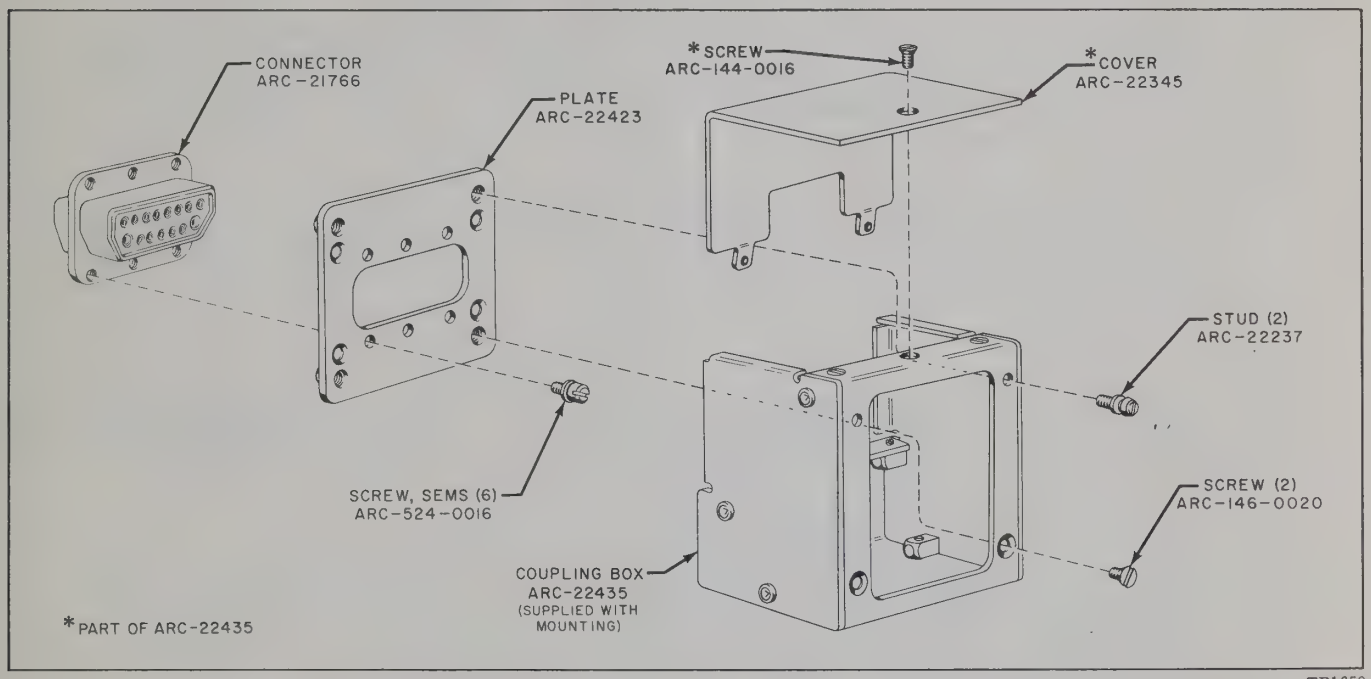

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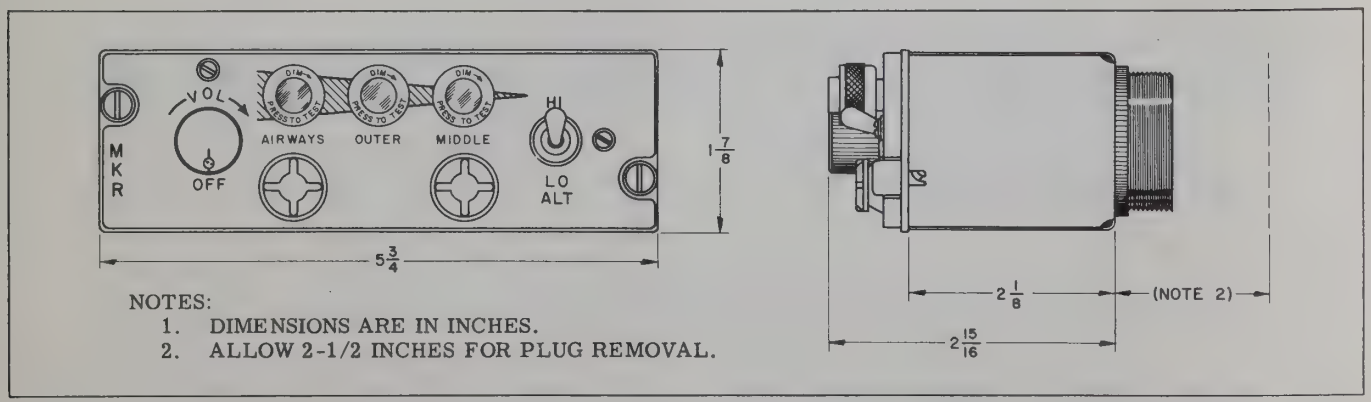
Figure 2–2. Assembly of Connector, Plate, and Coupling Box



NOTES:
1. DIMENSIONS ARE IN INCHES.
2. ALLOW 2-1/2 INCHES FOR PLUG REMOVAL.

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Figure 2–3. C-83A Control Unit, Installation Dimensions

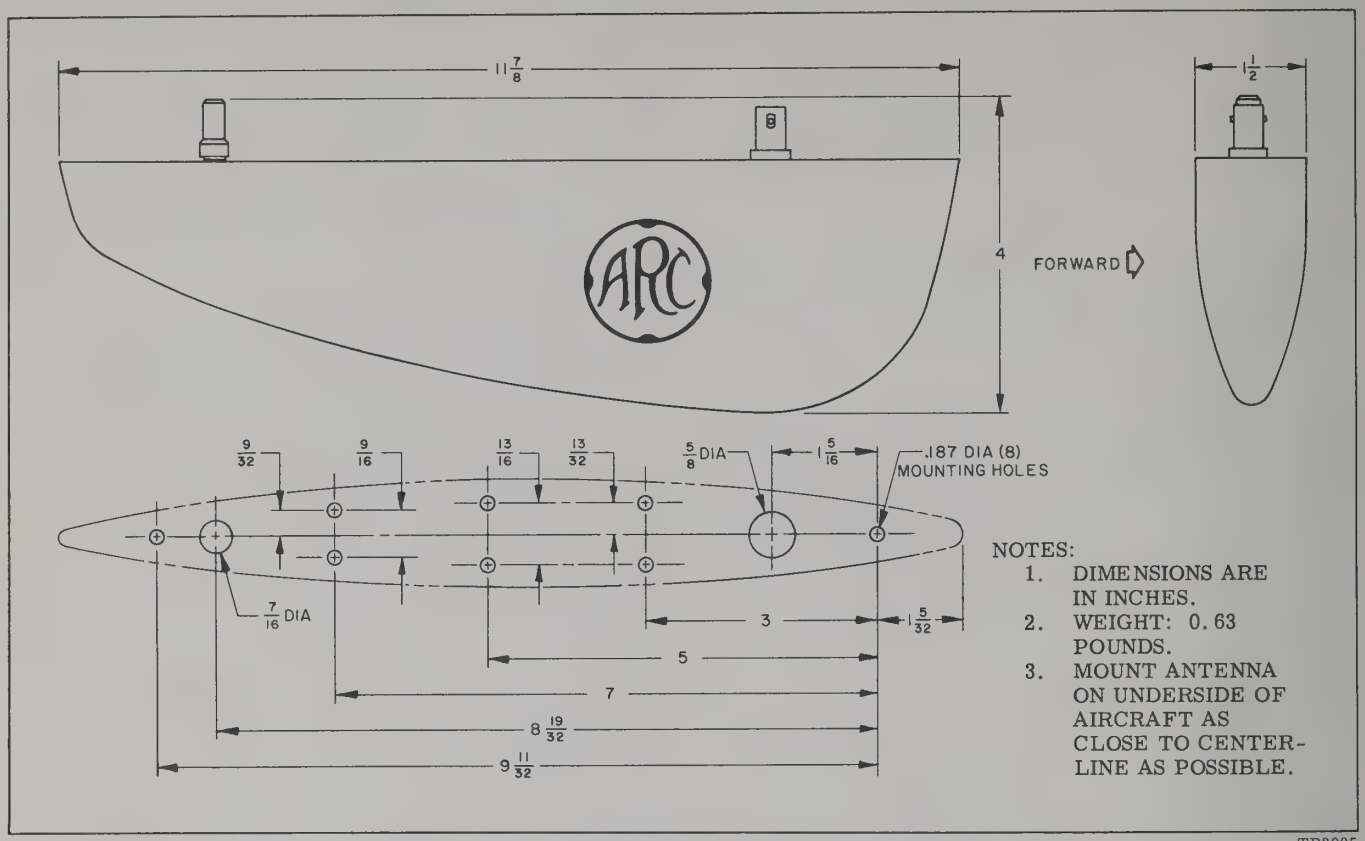

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Figure 2–4. A-24A Antenna, Installation Dimensions

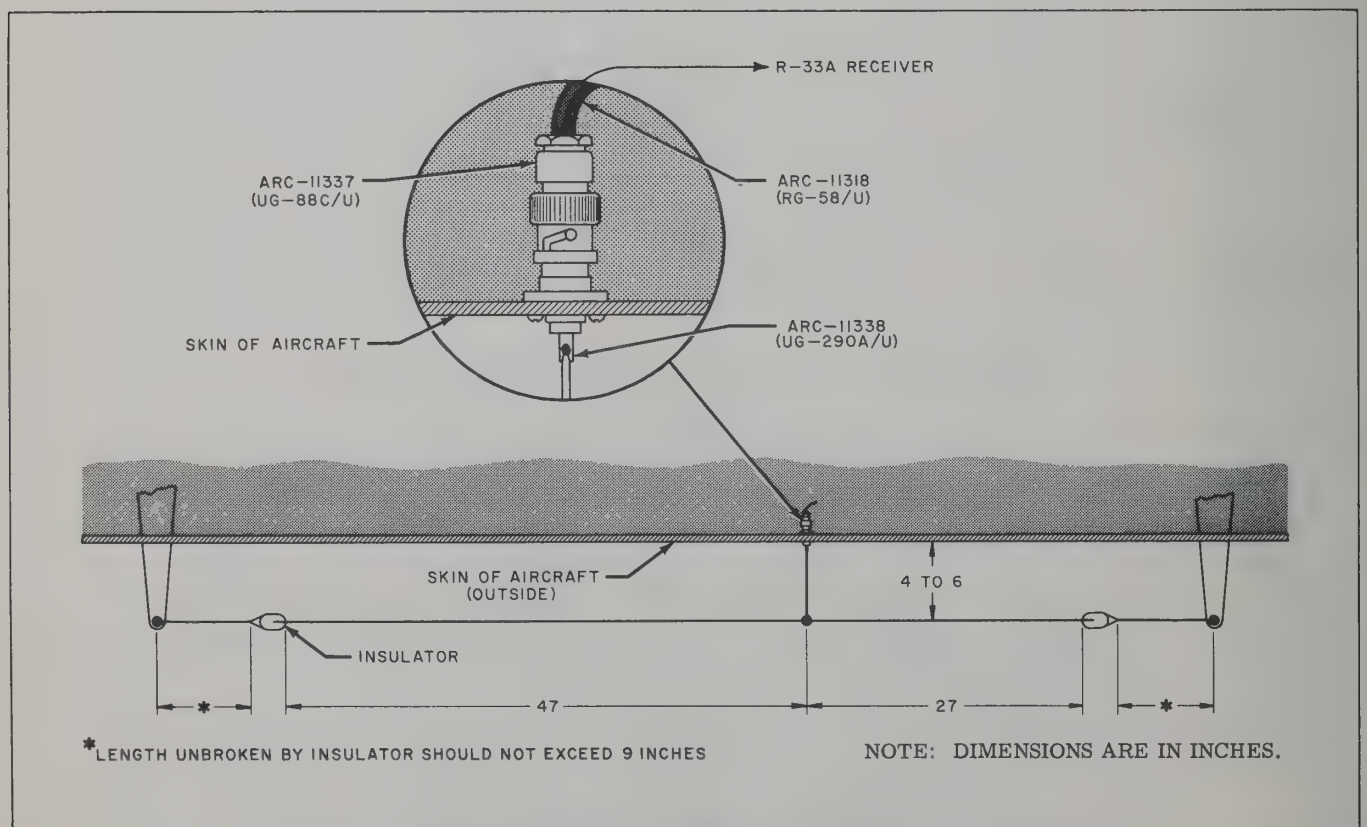

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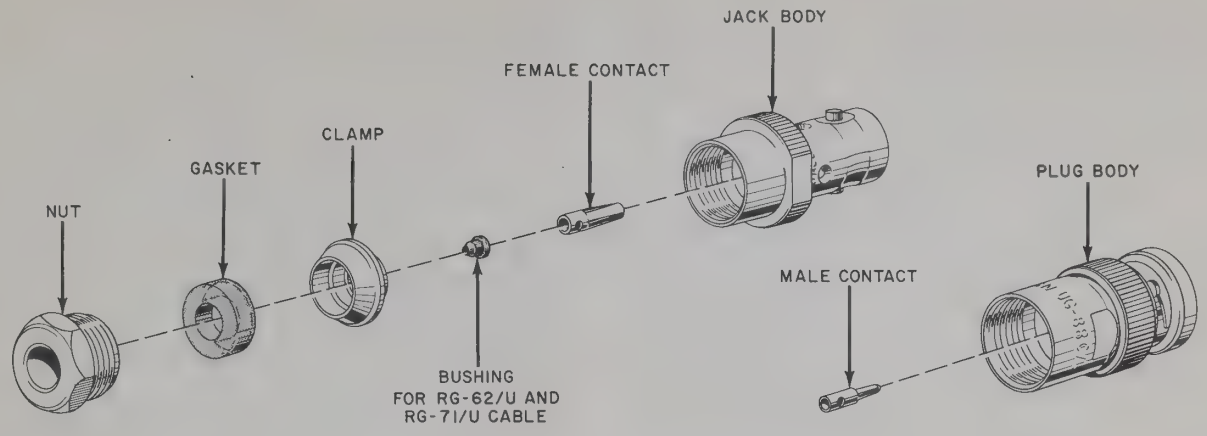
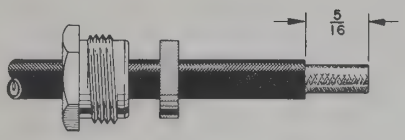
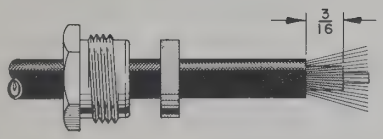
Figure 2–5. 75-megacycle Inverted-T Wire Antenna, Installation Diagram

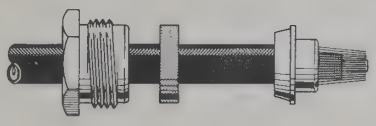




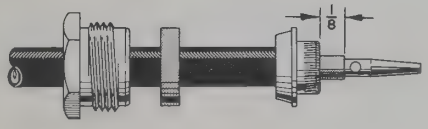
PLACE NUT AND GASKET OVER CABLE AND TRIM JACKET TO DIMENSION SHOWN. UNGROOVED FACE OF GASKET MUST BE TOWARD NUT.



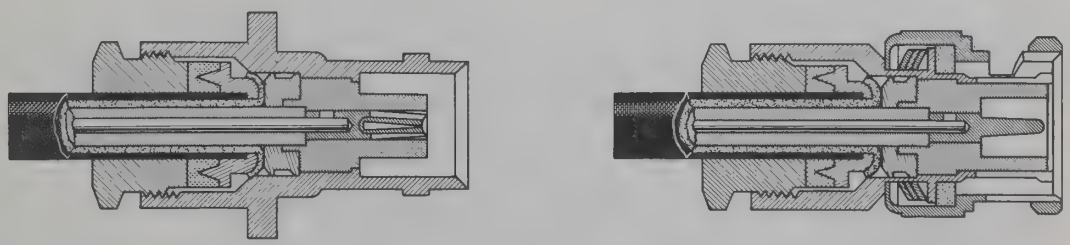
COMB OUT BRAID AND CUT CABLE DIELECTRIC TO DIMENSION SHOWN, BEING CAREFUL NOT TO NICK CENTER CONDUCTOR. TIN CENTER CONDUCTOR.



PULL BRAID WIRES FORWARD AND TAPER TOWARD CENTER CONDUCTOR. PLACE CLAMP OVER BRAID AND PUSH AGAINST CABLE JACKET.



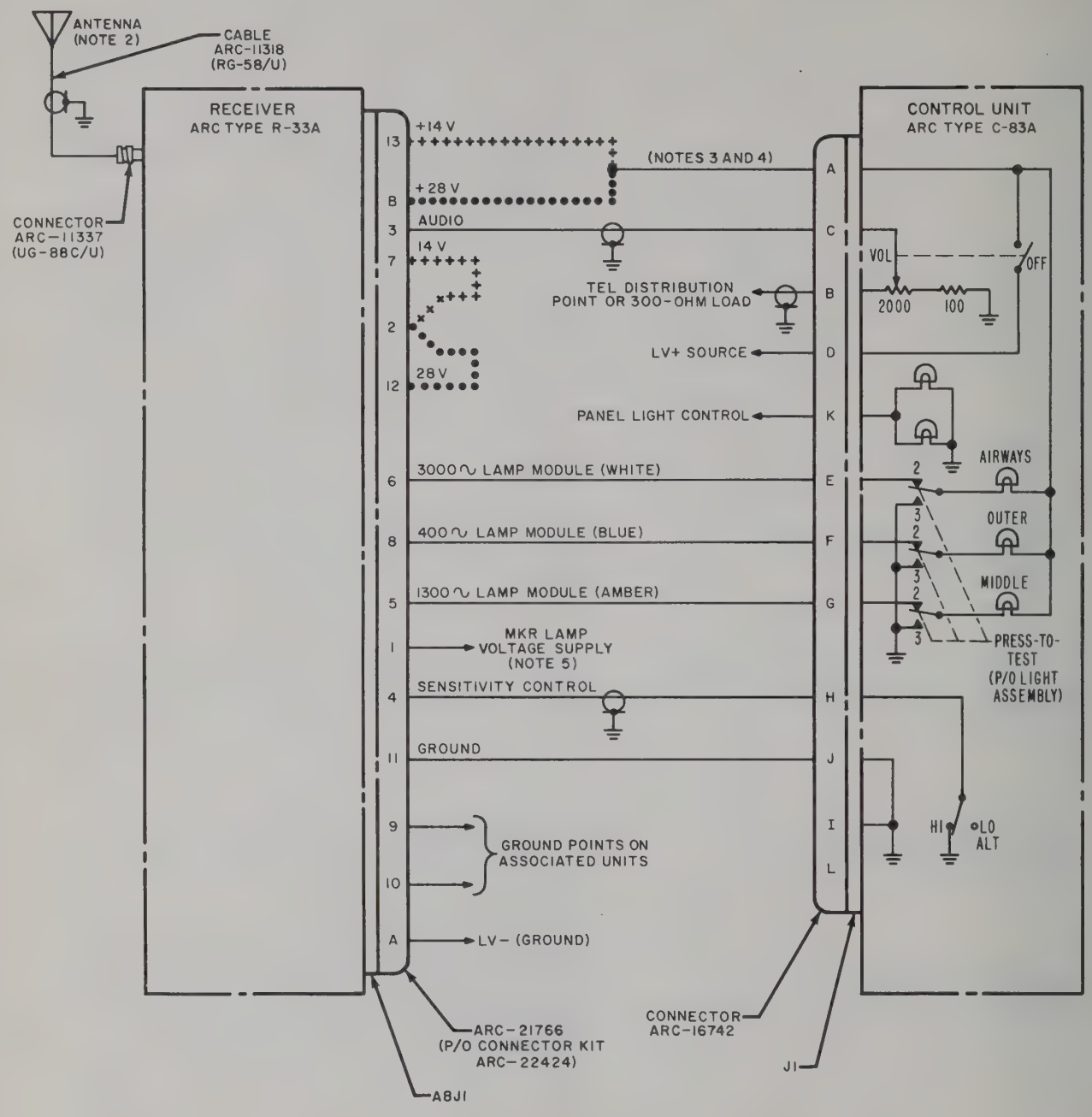
FOLD BACK BRAID WIRES AS SHOWN, TRIM TO PROPER LENGTH, AND FORM OVER CLAMP AS SHOWN. FOR RG-62/U AND RG-71/U CABLE, SLIP BUSHING OVER CENTER CONDUCTOR AND UNDER DIELECTRIC. SOLDER CONTACT TO CENTER CONDUCTOR.



INSERT CABLE AND PARTS INTO CONNECTOR BODY. MAKE SURE SHARP EDGE OF CLAMP SEATS PROPERLY IN GASKET. TIGHTEN NUT.

TP1731

Figure 2–6. Fabrication of Antenna Cable Assembly



NOTES:

1. SHIELDED WIRES ARE NO. 20 AWG SOLID, TINNED COPPER WITH BRAIDED SHIELD. ALL OTHER WIRES ARE NO. 20 AWG STRANDED COPPER, FIBROUS-GLASS INSULATED.
2. ARC TYPE A-24A OR EQUIVALENT 50-OHM, 75-MC ANTENNA.
3. FOR 14-VOLT OPERATION, CONNECT WIRES SHOWN AS + + + + AND OMIT WIRES SHOWN AS •••••••.
4. FOR 28-VOLT OPERATION, CONNECT WIRES SHOWN AS •••••• AND OMIT WIRES SHOWN AS + + + +.
5. FOR A CUSTOM CONTROL INSTALLATION, LAMP VOLTAGE MAY BE OBTAINED ALTERNATIVELY FROM A8J1 PIN 1.

22756B(TP)

Figure 2–7. R-33A Receiver and C-83A Control Unit, Interconnection Diagram

SECTION III
OPERATION

3–1. OPERATING LIMITATIONS AND PRECAUTIONS.

The ARC Type R-33A Receiver is a fixed-tuned, 75-megacycle receiver that provides visual and aural indications of airway and ILS marker beacon signals. There are no operating limitations or precautions.

3–2. MARKER BEACON FACILITIES.

Fan markers, located at specific points on the airways, serve as radio fixes or holding points. *Z markers,* located at the sites of radio range stations, identify the cone-of-silence area. *ILS outer markers,* located on the ILS localizer course, are approximately 5 miles from the approach end of the instrument runway. *ILS middle markers,* located on the ILS localizer course, are approximately 3500 feet from the approach end of the instrument runway. Table 3–1 lists the types of marker beacon facilities and their characteristics.

TABLE 3–1. MARKER BEACON FACILITIES

Marker	*Tone*	*Identifying Tone*	*Light*[1]
Fan	3000	1, 2, 3, or 4 dashes[2]	White
Z	3000	Continuous	White
Outer	400	2 dashes/sec	Blue
Middle	1300	Alternate dots and dashes	Amber

[1] If the identifying tone is keyed, the indicating light will blink accordingly.
[2] If there are two fan markers located on the same range course, the outer fan marker's dash (or dashes) will be prefixed by two dots.

3–3. OPERATING CONTROLS AND INDICATING LIGHTS.

The R-33A includes no operating controls or indicating lights, but the required operating controls are located externally and consist of a power switch, an optional volume control, and a high-low sensitivity switch; the power switch may be combined with the volume control. These controls and the three indicating lights required may be mounted separately on the instrument panel or they may be contained in a control unit such as the ARC Type C-83A Control Unit (see Figure 3–1).

3–4. OPERATION.

Note

The following procedure assumes the use of the ARC Type C-83A Control Unit but is applicable to similar control installations.

Step 1. Turn the VOL-OFF control clockwise to apply power to the receiver.

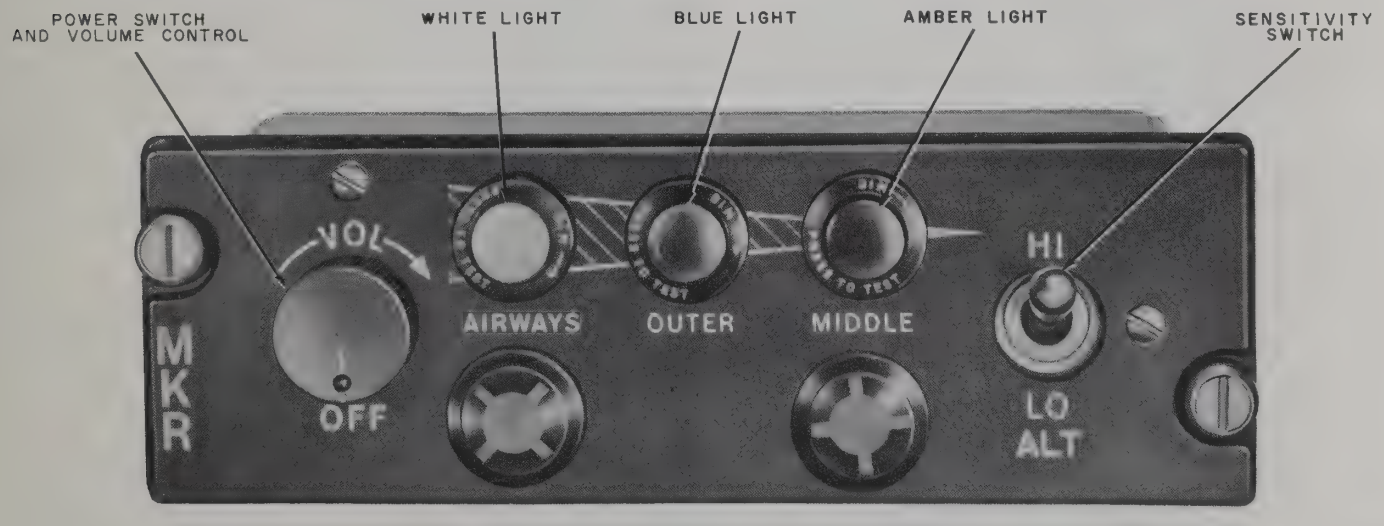
Note

One or more of the indicating lights may light momentarily.

Step 2. Press each lamp cap to test that the lamps are operative.

Step 3. Place the sensitivity switch in the HI position for high-altitude airway flying and in the LO position for ILS approaches.

Step 4. Adjust the audio level by rotating the VOL-OFF control to the setting desired.



TP1330

Figure 3–1. C-83A Control Unit, Operating Controls and Indicating Lights

SECTION IV
PRINCIPLES OF OPERATION

4–1. OVER-ALL FUNCTIONAL DESCRIPTION.

The ARC Type R-33A Receiver is a 75-mc, fixed-tuned receiver, with intermediate frequencies of 11.5 and 1.7 mc, which provides both visual and aural outputs. As shown in Figure 4–1, the functional circuits of the receiver are divided among seven modules consisting of r-f module A1, sensitivity control module A2, i-f module A3, af-agc module A4, and three lamp modules A5, A6, and A7.

In the r-f module, A1, a 75-mc bandpass filter with three tuned circuits, couples the antenna to a diode mixer. The selectivity and attenuation provided by this filter minimize interference by high-level television signals at adjacent frequencies. A crystal-controlled oscillator injects a 63.5-mc signal into a diode mixer. The output of the diode mixer is coupled through an 11.5-mc double-tuned filter to a transistor mixer. A second crystal-controlled oscillator injects a 9.8-mc signal into the transistor mixer to produce the final intermediate frequency of 1.7 mc.

The high selectivity of the receiver is mainly determined by a 1.7-mc triple-tuned filter, in sensitivity control module A2, that couples the second mixer to a high-gain, relatively broad-band, i-f amplifier. A diode variable attenuator is inserted before the i-f module, A3, as part of an automatic gain control circuit. The i-f module uses five transistors and has a gain of approximately 90 db.

The audio signal is detected in module A4 by a transistor coupled to a two-stage amplifier. A separate transistor is used as an audio squelch circuit to delay the audio signal until it approaches the light-operate threshold value. The final stage of the amplifier is push-pull and furnishes aural output into a 300-ohm impedance. The output of the low-impedance audio driver stage is fed to three frequency-selective amplifiers in the lamp modules, A5, A6, and A7. Each of the frequency-selective amplifiers uses a modified resistance-capacitance bridge, negative feedback arrangement to separate the marker modulation frequencies of 400, 1300, and 3000 cps. In each case, an isolation amplifier couples the output of the frequency-selective amplifier to a two-transistor threshold trigger circuit. The trigger circuit biases the base of a transistor switch to control lighting of an associated lamp. In addition to supplying the signal detector, the i-f amplifier drives a two-stage agc detector-amplifier. This amplifier has two outputs: one to control the bias of the variable attenuator in A2, the other to provide a varying bias for the second i-f amplifier.

4–2. R-F MODULE CIRCUITS.

75-mc Filter. As shown in the schematic diagram, Figure 6–1, the 75-mc marker beacon signal received by the antenna is coupled to the first mixer, CR1, through a 75-mc filter, Z1. The filter consists of three inductively tuned sections that are undercoupled for high selectivity to reject high-level television signals at adjacent frequencies (TV channels 4 and 5). A series capacitor connects the 75-mc signal to the first tuned section to reduce spurious responses at the i-f frequencies. The inductors of both the input and output sections are tapped for correct impedance matching.

First Crystal Oscillator. The first crystal oscillator uses a 2N384 p-n-p transistor, Q1, in a crystal-controlled Colpitts oscillator circuit. This circuit generates a 63.5-mc signal for series injection to the diode first mixer, CR1. The slug-tuned tank circuit of the oscillator forms the primary of r-f transformer T1. The low-impedance secondary of T1 couples the oscillator output to CR1. Crystal Y1, connected between the collector and base of Q1, operates in the series-third overtone mode. Voltage divider resistors R3 and R4 provide base bias for Q1.

First Mixer. A 1N82A diode, CR1, connected in series with the output of Z1 and the secondary of T1, is used for the first mixer. The 75-mc r-f signal from Z1 and the 63.5-mc output of Q1 are series-mixed in CR1 to produce an 11.5-mc first i-f frequency. CR1 is forward-biased by R1 and R2 to reduce noise and to provide more efficient detector action. Test jacks TP1 and TP2, normally connected by a jumper plug, P1, permit the use of a milliammeter during alignment of the first crystal oscillator.

11.5-mc Filter. The 11.5-mc first i-f signals from CR1 are coupled to the second mixer, A2Q1, through an 11.5-mc filter, Z2. The filter contains two undercoupled, inductively tuned sections in a hermetically sealed unit to provide additional selectivity and rejection of unwanted signals. Both the input and output inductors are tapped for correct impedance matching. To conserve space, the r-f transformer for the second crystal oscillator, Q2, is also included in this assembly.

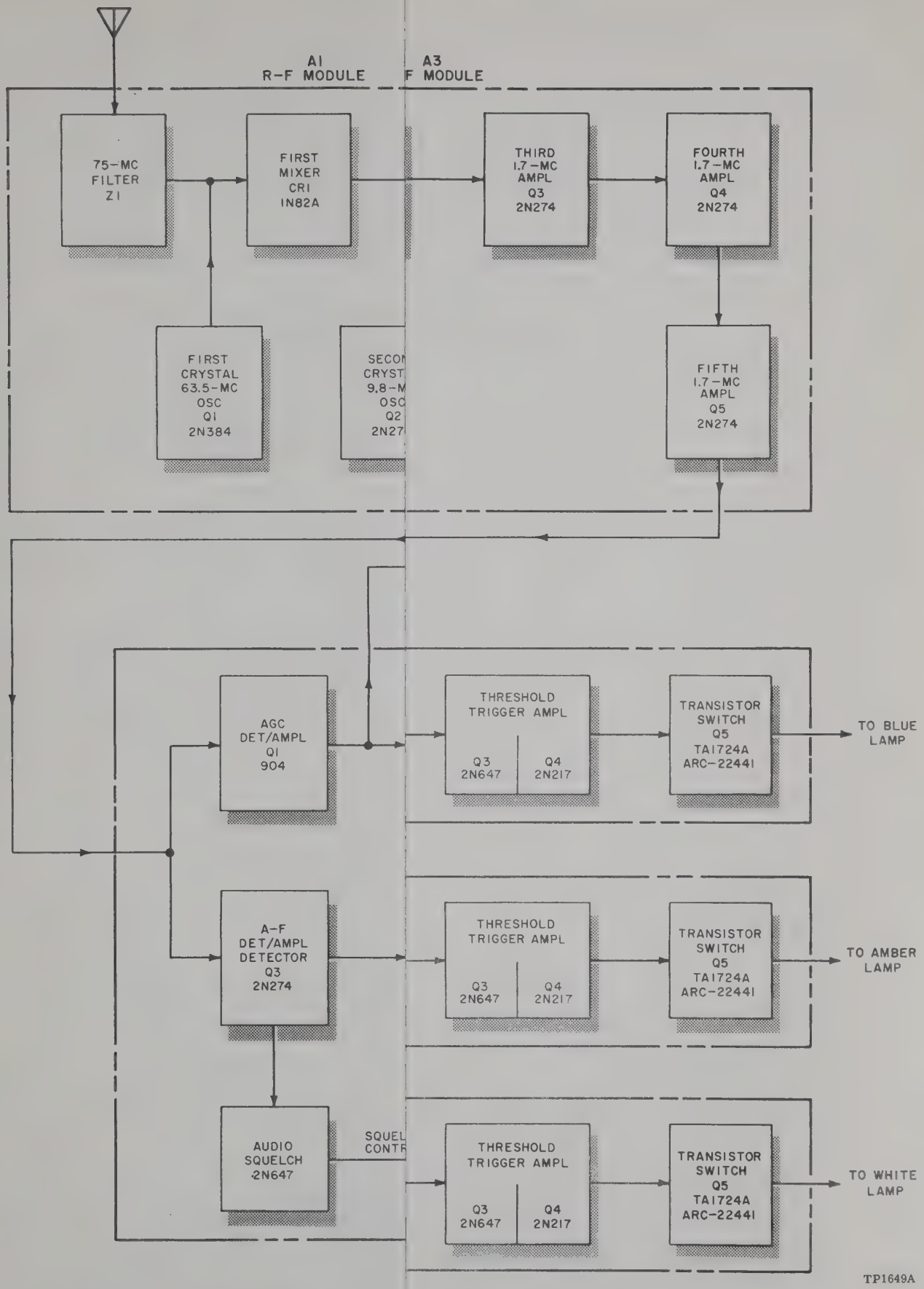


Figure 4–1. R-33A Receiver, Block Diagram

SECTION IV
PRINCIPLES OF OPERATION

4–1. OVER-ALL FUNCTIONAL DESCRIPTION.

The ARC Type R-33A Receiver is a 75-mc, fixed-tuned receiver, with intermediate frequencies of 11.5 and 1.7 mc, which provides both visual and aural outputs. As shown in Figure 4–1, the functional circuits of the receiver are divided among seven modules consisting of r-f module A1, sensitivity control module A2, i-f module A3, af-agc module A4, and three lamp modules A5, A6, and A7.

In the r-f module, A1, a 75-mc bandpass filter with three tuned circuits, couples the antenna to a diode mixer. The selectivity and attenuation provided by this filter minimize interference by high-level television signals at adjacent frequencies. A crystal-controlled oscillator injects a 63.5-mc signal into a diode mixer. The output of the diode mixer is coupled through an 11.5-mc double-tuned filter to a transistor mixer. A second crystal-controlled oscillator injects a 9.8-mc signal into the transistor mixer to produce the final intermediate frequency of 1.7 mc.

The high selectivity of the receiver is mainly determined by a 1.7-mc triple-tuned filter, in sensitivity control module A2, that couples the second mixer to a high-gain, relatively broad-band, i-f amplifier. A diode variable attenuator is inserted before the i-f module, A3, as part of an automatic gain control circuit. The i-f module uses five transistors and has a gain of approximately 90 db.

The audio signal is detected in module A4 by a transistor coupled to a two-stage amplifier. A separate transistor is used as an audio squelch circuit to delay the audio signal until it approaches the light-operate threshold value. The final stage of the amplifier is push-pull and furnishes aural output into a 300-ohm impedance. The output of the low-impedance audio driver stage is fed to three frequency-selective amplifiers in the lamp modules, A5, A6, and A7. Each of the frequency-selective amplifiers uses a modified resistance-capacitance bridge, negative feedback arrangement to separate the marker modulation frequencies of 400, 1300, and 3000 cps. In each case, an isolation amplifier couples the output of the frequency-selective amplifier to a two-transistor threshold trigger circuit. The trigger circuit biases the base of a transistor switch to control lighting of an associated lamp. In addition to supplying the signal detector, the i-f amplifier drives a two-stage agc detector-amplifier. This amplifier has two outputs: one to control the bias of the variable attenuator in A2, the other to provide a varying bias for the second i-f amplifier.

4–2. R-F MODULE CIRCUITS.

75-mc Filter. As shown in the schematic diagram, Figure 6–1, the 75-mc marker beacon signal received by the antenna is coupled to the first mixer, CR1, through a 75-mc filter, Z1. The filter consists of three inductively tuned sections that are undercoupled for high selectivity to reject high-level television signals at adjacent frequencies (TV channels 4 and 5). A series capacitor connects the 75-mc signal to the first tuned section to reduce spurious responses at the i-f frequencies. The inductors of both the input and output sections are tapped for correct impedance matching.

First Crystal Oscillator. The first crystal oscillator uses a 2N384 p-n-p transistor, Q1, in a crystal-controlled Colpitts oscillator circuit. This circuit generates a 63.5-mc signal for series injection to the diode first mixer, CR1. The slug-tuned tank circuit of the oscillator forms the primary of r-f transformer T1. The low-impedance secondary of T1 couples the oscillator output to CR1. Crystal Y1, connected between the collector and base of Q1, operates in the series-third overtone mode. Voltage divider resistors R3 and R4 provide base bias for Q1.

First Mixer. A 1N82A diode, CR1, connected in series with the output of Z1 and the secondary of T1, is used for the first mixer. The 75-mc r-f signal from Z1 and the 63.5-mc output of Q1 are series-mixed in CR1 to produce an 11.5-mc first i-f frequency. CR1 is forward-biased by R1 and R2 to reduce noise and to provide more efficient detector action. Test jacks TP1 and TP2, normally connected by a jumper plug, P1, permit the use of a milliammeter during alignment of the first crystal oscillator.

11.5-mc Filter. The 11.5-mc first i-f signals from CR1 are coupled to the second mixer, A2Q1, through an 11.5-mc filter, Z2. The filter contains two undercoupled, inductively tuned sections in a hermetically sealed unit to provide additional selectivity and rejection of unwanted signals. Both the input and output inductors are tapped for correct impedance matching. To conserve space, the r-f transformer for the second crystal oscillator, Q2, is also included in this assembly.

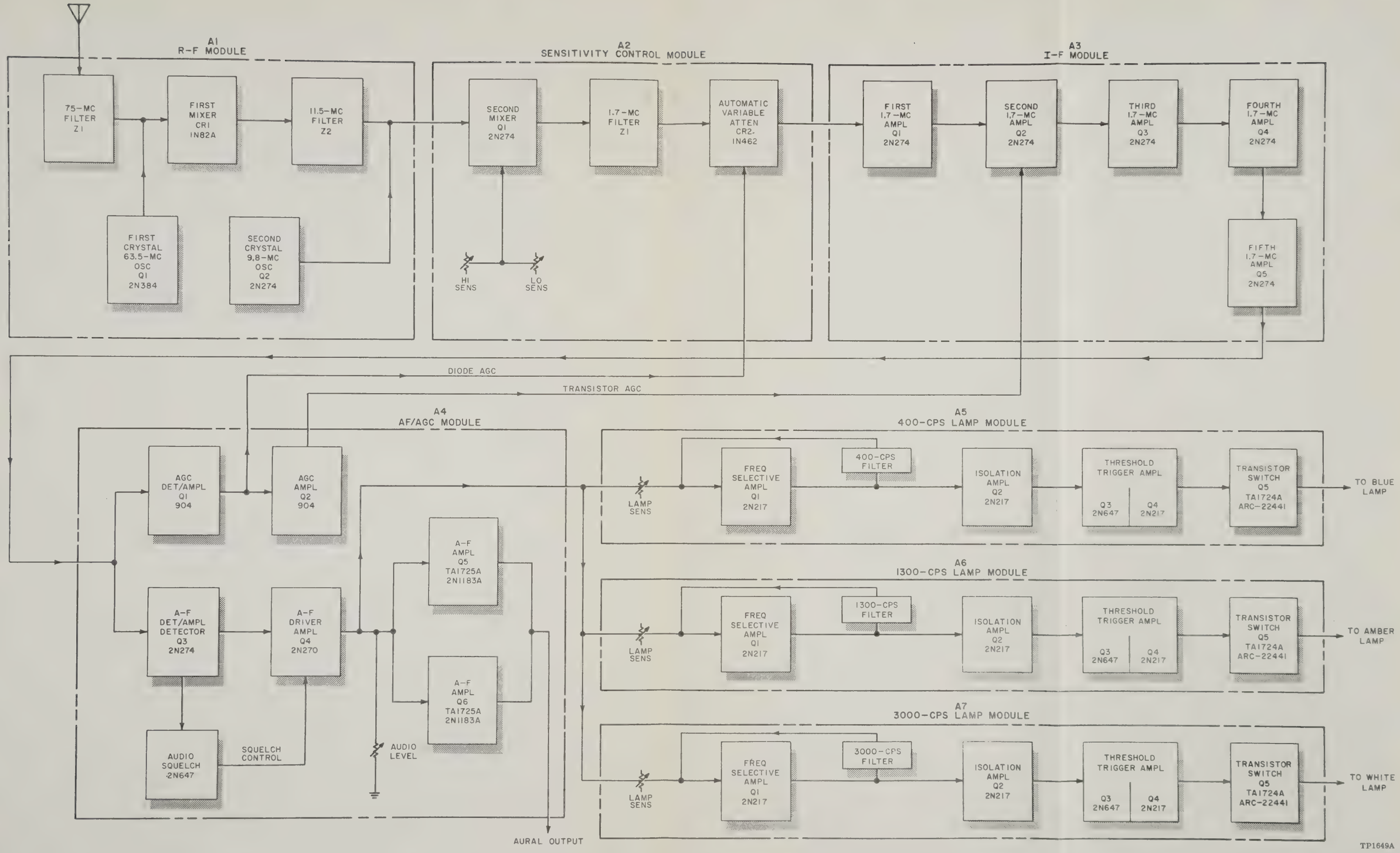


Figure 4–1. R-33A Receiver, Block Diagram

Second Crystal Oscillator. A 2N274 p-n-p transistor, Q2, in a Colpitts circuit is used for the second crystal oscillator. This circuit generates a 9.8-mc signal for series injection to the second mixer, A2Q1. Crystal Y2, connected between the base and collector of Q2, operates at its fundamental frequency of 9.8 mc. Operating base bias for Q2 is provided by voltage-divider resistors R9 and R10. The slug-tuned tank circuit of the oscillator forms the primary of the r-f transformer contained in Z2. The low-impedance secondary of the r-f transformer couples the oscillator output to the base of the second mixer, A2Q1.

4–3. SENSITIVITY CONTROL MODULE CIRCUITS.

Second Mixer. The second mixer uses a 2N274 p-n-p transistor, Q1. The 11.5-mc signals from A1Z2 and the series-injected 9.8-mc signal from A1Q2 are mixed in Q1 to produce a second i-f frequency signal at 1.7 mc. Operating base bias for Q1 is provided by R5 and R6 in module A1.

The over-all sensitivity of the R-33A is manually controlled at the second mixer by the remote selection of one of two i-f shunt return paths in the emitter circuit. When the sensitivity switch is in the LO position, pin F of module A2 is not grounded, reverse-biasing diode switch CR1. The emitter i-f return path is then through C2, R4, LO SENS control R5, and C3; the mixer is highly degenerative due to the unbypassed resistance in the emitter circuit. In the HI position, pin F of A2 is grounded and forward-biases CR1. With CR1 conducting, the return path is through CR1, HI SENS control R7, and C4, which are connected in parallel with the LO SENS control path. Since the HI SENS control path is adjusted to have lower resistance than the LO SENS control path, the mixer has less degeneration (more conversion gain) in the high-sensitivity condition. During alignment of the R-33A, first the LO SENS control is adjusted and then the HI SENS control is adjusted to obtain the desired over-all sensitivity settings.

Resistors R1 and R2 provide the emitter d-c return path; C2 and R2 decouple the emitter circuit from the regulated 10-volt supply. Bias for the anode of A2CR1 is supplied by R3, R4, R5, and R6. The d-c return path for the cathode of CR1 is provided by R7, R8, and R9 for the low-sensitivity condition (CR1 reverse-biased), and by R7 and R8 in the high-sensitivity condition (CR1 forward-biased).

1.7-mc Filter. A 1.7-mc filter, Z1, is used to couple the output of the second mixer, through a variable attenuator, to a high-gain, relatively nonselective 1.7-mc amplifier. A major portion of the over-all selectivity of the R-33A Receiver is determined by this filter. (The 6-db bandpass of the R-33A is approximately 25 kc on each side of the 75-mc carrier.) The filter contains three slightly under-coupled, inductively tuned sections in a hermetically sealed unit. Both the input and output inductors are tapped for correct impedance matching. A 33,000-ohm shunt resistor, internally connected between the input tap and ground, is used to help control the over-all response of the filter.

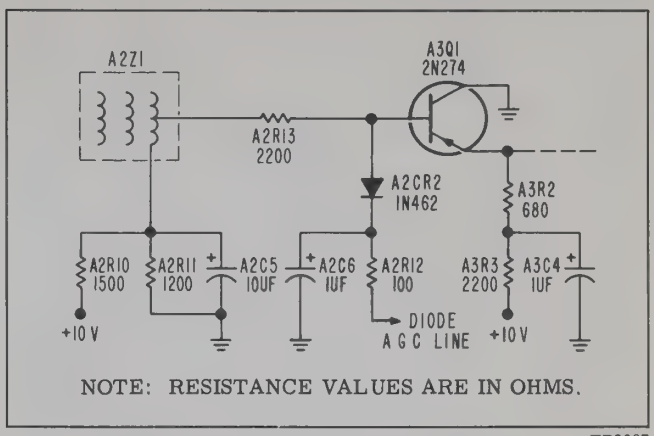


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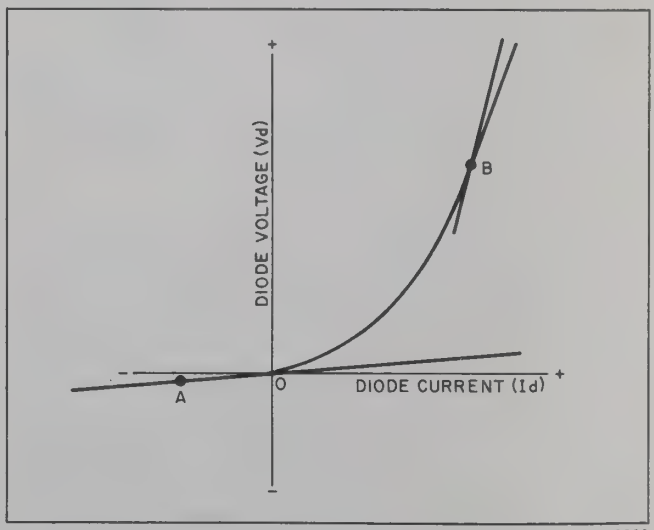
Figure 4–2. Variable Attenuator, Simplified Schematic Diagram

Automatic Variable Attenuator. A 1N462 silicon diode, CR2, connected in parallel with the input to the first 1.7-mc amplifier, A3Q1, is used as an automatic variable attenuator (see Figure 4–2). This stage, a part of the automatic gain control circuit, automatically controls the amount of signal fed to the input of A3Q1 to prevent clipping at high signal levels. The output of Z1 is connected through R13 to the paralleled circuit of CR2 and the base of A3Q1. At low signal levels, CR2 is reverse-biased so that its impedance is high. In Figure 4–3, this condition is represented by the tangent to the operating point A of the diode current-voltage characteristic; at this point the diode has practically no loading effect on



TP3089

Figure 4–3. Diode Characteristic Showing Change in Impedance with Operating Points

the input of A3Q1. As the voltage on the diode agc line becomes increasingly negative, CR2 starts to conduct and presents a much lower impedance as represented by the tangent to operating point B in Figure 4–3. This impedance is now much less than the input resistance of A3Q1, and the voltage division between CR2 and the base input of A3Q1 is controlled by the voltage on the diode agc line. Use of the automatic variable attenuator, coupled with one amplifying stage, A3Q2, under conventional agc control results in an i-f output change of less than 6 db from 200 to 250,000 microvolts without objectionable distortion due to clipping in the control stage. Reverse bias for CR2 and operating base bias for A3Q1 is provided by R10 and R11. R12 and C6 are used to decouple CR2 from the diode agc line.

4–4. I-F MODULE CIRCUITS.

Five 2N274 transistors, Q1 through Q5, are used to amplify the 1.7-mc i-f signal. The i-f amplifier is relatively nonselective and has an over-all gain of approximately 90 db. The first i-f amplifier, Q1, is connected as an emitter-follower (common-collector) to present a high impedance to the variable attenuator, A2CR2. R2 and R3 provide the emitter d-c return path; R3 and C4 decouple the emitter circuit from the 10-volt regulated supply.

The second i-f amplifier, Q2, is connected in a common-emitter circuit and is the only stage in the amplifier that has agc. The base of Q2 is returned to the transistor agc line through a decoupling circuit consisting of L1, C2, R4, C1, and R1. The emitter circuit of Q2 is decoupled from the 10-volt regulated supply by R6 and C6; R6 is a relatively high-value resistor in the emitter circuit to provide d-c degeneration for temperature stability.

The third i-f amplifier stage, Q3, is similar to the second stage except that it is not agc-controlled. The base of Q3 is returned to fixed bias provided by R7 and R8.

The fourth i-f amplifier stage, Q4, is similar to the preceding stage except that the collector load consists of a broadly-tuned 1.7-mc tank circuit (C13 and L4). L4 is tapped for correct impedance-matching to the input of the following stage.

The fifth i-f amplifier, Q5, is connected in a common-base circuit (equivalent to a grounded-grid vacuum tube circuit) to obtain a relatively high output impedance. Fixed base bias is provided by R18 and R20. R16 and R17 provide the emitter d-c return path; R17 and C19 decouple the emitter circuit from the 10-volt regulated supply. Q5 has two outputs: the full output at the collector, which is directly connected to the base of agc detector-amplifier A4Q1, and a tapped output from capacitor divider C16 and C17, which is connected to the base of audio detector A4Q3.

4–5. AF-AGC MODULE CIRCUITS.

Agc Detector-amplifier. A 904 n-p-n transistor, Q1, is used for the agc detector-amplifier. The base-emitter diode section of Q1 detects the 1.7-mc i-f signal. For no-signal conditions, Q1 is reverse-biased to obtain delayed agc action. The reverse-bias is established by R1 and R2. When the positive peaks of the input signal rise above the delay level, Q1 will detect the positive peaks and generate a d-c voltage proportional to the signal. The emitter-collector circuit of Q1 amplifies the rectified signal which is directly coupled to the base of agc amplifier Q2. C1 and C2 help filter the rectified signal.

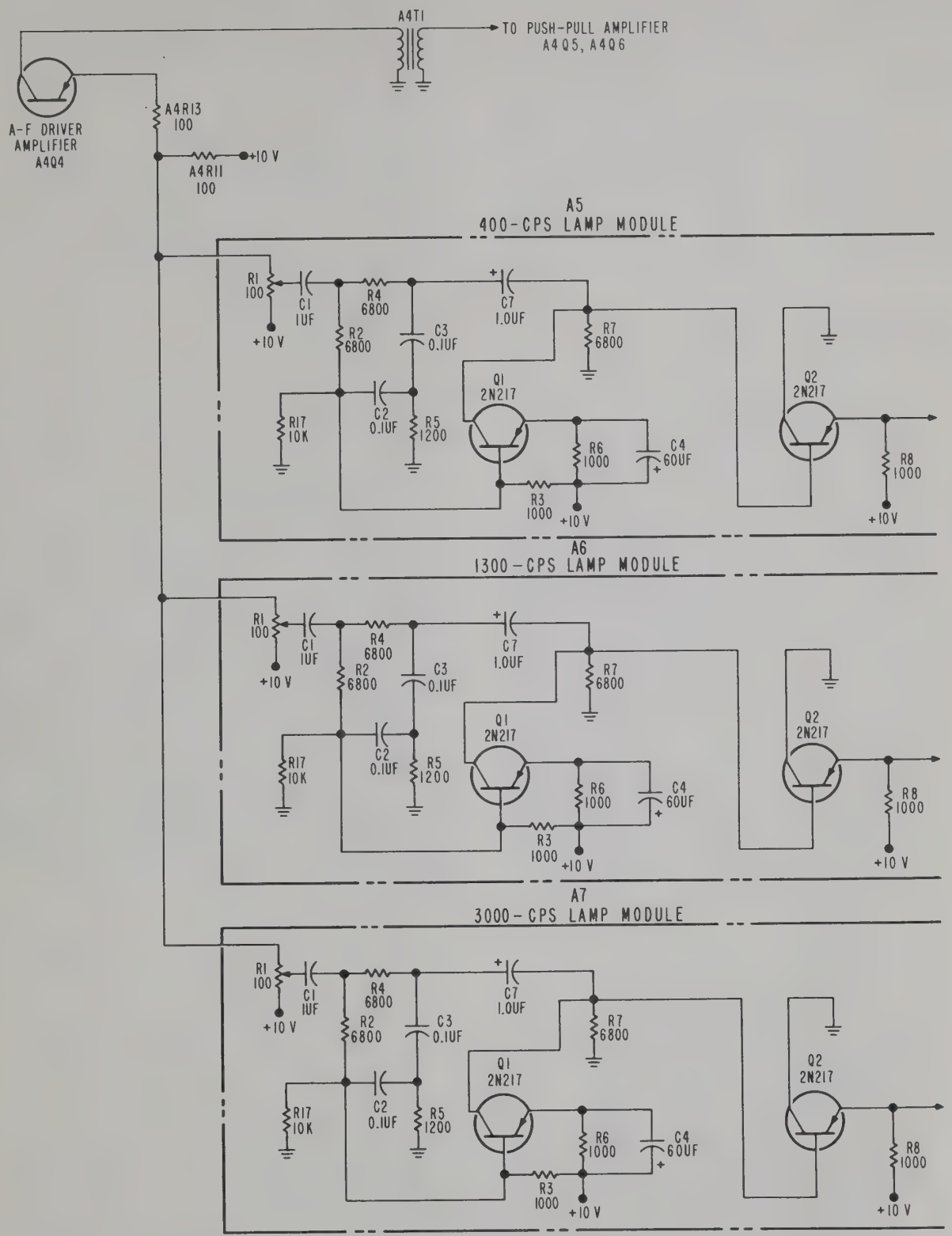
Agc Amplifier. Q2, a 904 transistor, is used for the second stage of agc amplification. The transistor is used as a d-c amplifier connected in a common-emitter circuit. The conduction of Q2 is varied in accordance with the d-c input, tending towards cutoff as the signal increases. Q2 has two d-c outputs: a negative-going output taken from the emitter for the diode agc bias, and a positive-going output taken from the collector for the transistor agc bias. Fixed bias for Q2 is provided by R3 and R4.

A-f Detector-amplifier. A 2N274 p-n-p transistor, Q3, connected in a common-emitter circuit, is used as an amplifying detector for the audio channel.

A-f Driver Amplifier. The a-f driver amplifier uses a 2N270 p-n-p transistor, Q4, connected in a common-emitter circuit. The output of Q3 is directly coupled to the base of Q4, with R12 serving as the collector resistor for Q3 and the base resistor for Q4.

The driver amplifier has two audio outputs: one taken from a voltage divider in the emitter circuit is used to drive the three frequency-selective lamp modules in parallel; the other taken from the collector is used to drive the push-pull amplifier. Volume level control A8R3 on the front panel of the R-33A is connected in shunt with the output of the push-pull amplifier to serve as a volume control. (A8R3 is adjusted at the time of installation for any aural output level desired up to 250 milliwatts.) R14 and C8, aided by C6, form an a-f filter to establish the high-frequency cut-off at approximately 3000 cps.

A-f Push-pull Amplifier. Two 2N1183A p-n-p transistors, Q5 and Q6, connected in a class AB_1 push-pull circuit, are used for the final audio stage. T1 couples the audio output of Q4 to the bases of Q5 and Q6. The center tap of T1 is connected directly to the aircraft's primary supply voltage. Forward bias for the bases of the transistors is provided by the voltage dividers consisting of the secondary windings of T1, R15, and R16. The audio output of the push-pull amplifier is coupled to the headset line through T2. The required amount of degeneration is provided by emitter resistors R17 and R18.



NOTE: RESISTANCE VALUES ARE IN OHMS; MULTIPLIER K=1000.

TP3091

Figure 4–4. Connection of Audio Output to Frequency Selective Amplifiers

Audio Squelch. A 2N647 n-p-n transistor, Q7, is used as an audio squelch circuit to delay the audio signal until it approaches the light operate threshold value. For no-audio signal, driver amplifier Q4 is cut off, being reverse-biased by R6 and R13. The r-f signal appearing at the collector of Q3 is coupled to the base of Q7 through C6. L3 acts as a return to ground for the audio signal as well as a d-c return for the base of Q7. The collector of Q7 is direct-coupled to the base of Q4. As the r-f signal appearing at the base of Q7 increases, Q7 will start to conduct, changing the base voltage of Q4 so that Q4 conducts and functions as the audio driver amplifier.

4–6. LAMP MODULE CIRCUITS.

General. The low-impedance audio output from the tapped emitter circuit of the driver a-f amplifier, A4Q4, is fed to the frequency-selective input amplifier of each of three lamp modules (see Figure 4–4). Each of the frequency-selective amplifiers uses a modified resistance-capacitance bridge, negative feedback arrangement, to separate the marker modulation frequencies of 400, 1300, and 3000 cps. With the exception of the values of resistors and capacitors used in the filters, the parts used in all three lamp modules are identical. The following description of lamp module A5 is also applicable to the 1300- and 3000-cps lamp modules.

Frequency-selective Amplifier. A 2N217 p-n-p transistor connected in a common-emitter circuit is used for the frequency-selective amplifier, Q1. The audio signal from A4Q4 is fed through lamp-sensitivity control R1 to the resistance-capacitance 400-cps filter. The negative feedback 400-cps filter is in the form of a bridge and is shown in Figure 4–5. The transistor output voltage is at a maximum when the feedback current is at a minimum and occurs when the bridge is balanced. As shown in the amplifier response curve of Figure 4–6, with this type of filter (400 cps), at least 20 db of rejection is achieved to the adjacent audio channel (1300 cps). Base bias is provided by R3 and R17.

Isolation Amplifier. A 2N217 transistor, Q2, connected as an emitter-follower (common-collector), is used as an isolation amplifier to match the relatively high-impedance output of Q1 to the low-impedance input of Q3. The output of Q1 is directly connected to the base of Q2, with R7 serving as the collector resistor for Q1 and the base resistor for Q2. The output of Q2 is coupled to the base of Q3 through C5.

Threshold Trigger Amplifier. The threshold trigger amplifier consists of a 2N647 n-p-n transistor, Q3, and a 2N217 p-n-p transistor, Q4, connected as a complementary pair (see Figure 4–7). Under no-signal conditions, both transistors are cut off. Reverse bias for the base of Q3 is provided by R9 and R10; reverse bias for the emitter of Q4 is provided by R11, R12, and R14. As the audio input signal increases beyond the threshold level, Q3 acts as a positive-peak rectifier, charging capacitor C6, connected between the collector and emitter of Q3. When the charge on C6 is sufficient to overcome the reverse bias on Q4, Q4 conducts. The potential from the negative-going emitter of Q4 is fed back to the emitter of Q3, causing Q3 to conduct. The output of Q3 is fed to the base of Q4, causing the circuit to be highly regenerative. Therefore, stability in any region between cutoff and full conduction cannot be achieved; that is, the circuit is either on or off, with very sharp switching action. When the incoming signal decreases to the threshold level where the charge on C6 is less than the reverse bias on Q4, Q4 cuts off, causing Q3 to cut off.

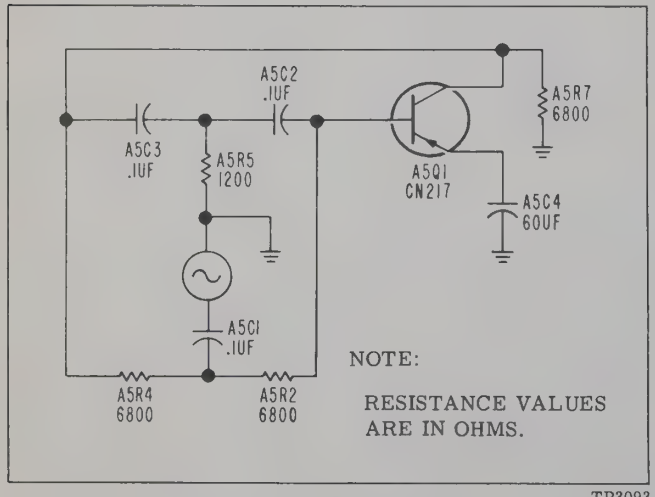


Figure 4–5. 400-cps Filter, Simplified Schematic Diagram

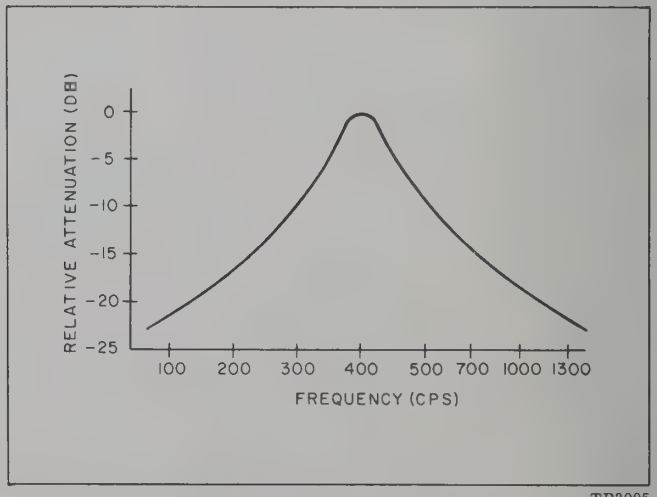


Figure 4–6. Relative Response of 400-cps Frequency-selective Amplifier

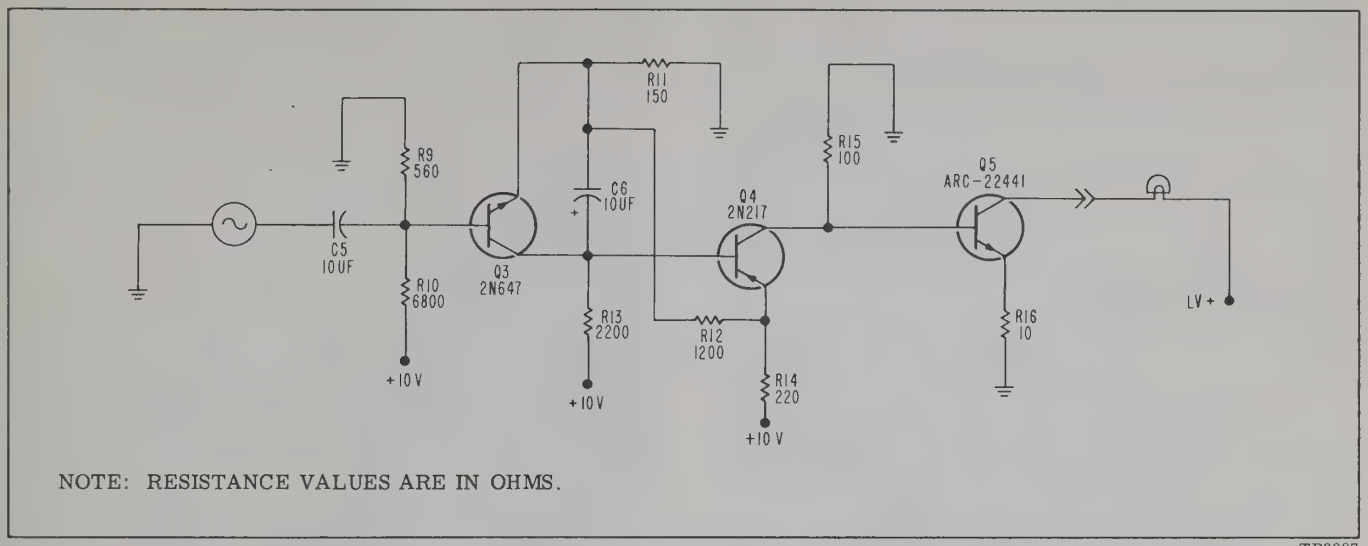


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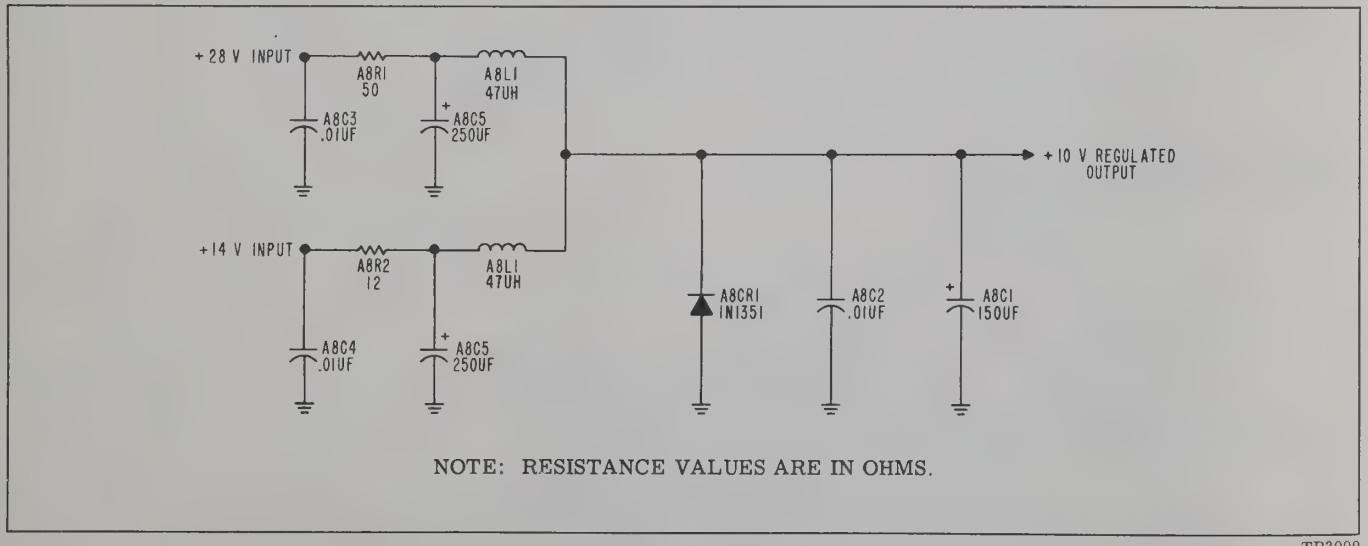
Figure 4–7. Threshold Trigger Amplifier and Transistor Switch Circuits, Simplified Schematic Diagram

Transistor Switch. An ARC-22441 n-p-n transistor, Q5, connected in a common-emitter circuit, is used as a transistor switch to control operation of the associated indicating lamp (see Figure 4–7). Under no-signal conditions, Q5 is reverse biased so that it is cut off. When the audio input signal to the threshold trigger circuit exceeds the threshold level, Q4 conducts, and its positive-going collector causes Q5 to conduct. When Q5 conducts, the associated indicating lamp in the collector circuit of Q5 will light, indicating reception of a marker beacon signal modulated at 400 cps.

10-volt Regulated Supply. A schematic of the 10-volt regulated supply used for all circuits of the R-33A, except the push-pull audio amplifier and the lamp transistor switches, is shown in Figure 4–8. Either 14-volt or 28-volt operation of the R-33A is obtained by connecting the external cabling to the appropriate terminal of connector A8J1. For 28-volt operation, the voltage is dropped through a 50-ohm resistor, A8R1, then through a hash filter consisting of A8C5, A8L1, and A8C1, to a 1N1351 voltage-regulating (10-volt Zener) diode. For 14-volt operation, the circuit is the same except that a 12-ohm voltage-dropping resistor, A8R2, is used. The dynamic impedance of the voltage regulating diode when conducting in its Zener (breakdown) region is very low. When used with A8C1, the combination forms a regulated, low-impedance, d-c supply so that any variations in the aircraft's primary supply are not reflected in the receiver.

R-f Filter. A pi-type r-f filter consisting of A8C6, A8C7, and A8L2 is inserted in the audio output lead (pin 3 of A8J1) to eliminate conducted r-f interference. A similar r-f filter is inserted in sensitivity switch lead (pin 4 of A8J1).



TP3099

Figure 4–8. 10-volt Regulated Supply, Schematic Diagram

SECTION V
MAINTENANCE

5–1. INTRODUCTION.

This section contains maintenance data for the ARC Type R-33A Marker Beacon Receiver. Included are a list of the test equipment required for maintenance, removal and replacement procedures, over-all performance checks, trouble analysis information, alignment and adjustment procedures, and voltage measurements. To help locate and identify individual parts, interior views of the R-33A Receiver and the C-83A Control Unit are also included in this section. Complete schematic and wiring diagrams of the units are included in Section VI.

5–2. TEST EQUIPMENT.

Table 5–1 lists the test equipment required for maintenance of the R-33A; equivalent test equipment may be substituted. An interconnection diagram for the R-33A bench test setup is shown in Figure 5–1.

5–3. REMOVAL AND REPLACEMENT PROCEDURES.

Caution

To prevent damaging the miniature parts of the receiver, handle the receiver and its modules by the external framework only.

Removal of Modules. For access to modules A1 through A7, release the Dzus fastener at the rear of the R-33A and slide the dust cover off. To remove a module, remove the chassis screw at each end of the module. Insert a screwdriver in the chassis slot at each end of the module and apply force upward until the jacks on the edge of the module printed-circuit board disconnect from the pins on the chassis printed-circuit board. Remove the screwdrivers and lift the module out.

Note

Before completely removing r-f module A1, disconnect coaxial cable A8W1 from the module.

Replacement of Modules. To replace a module, slide it in place in the receiver chassis until the jacks on the module fully engage the pins on the chassis printed-circuit board. Secure the module to the chassis by replacing the chassis screw at each end of the module.

Replacement of Transistors. To replace a transistor, remove the module on which the transistor is mounted. If the transistor is a plug-in type, remove the two screws fastening the transistor clamping plate to the module frame; then remove the clamping plate and the plug-in transistor. To install a plug-in transistor, reverse the procedure.

TABLE 5–1. TEST EQUIPMENT

Qty	Name	Designation	Characteristics
1	Ammeter	Weston Model 301	0-1 amp dc[1]
1	Attenuator	Boonton Radio Corp. Type 505-B	6-db, 50-ohm impedance
1	Audio Oscillator	Hewlett-Packard Model 200AB	—
1	Control Unit	ARC Type C-83A	—
1	Dummy Dust Cover	—	(See Figure 5–3)
1	Headset	ARC-11935	600-ohm impedance
1	Low-voltage Supply	—	14- or 28-volt dc rectifier or storage battery
1	Milliammeter	Weston Model 301	0-5 ma dc
1	Oscilloscope[2]	Tektronix Type 310	—
1	Resistor	Allen-Bradley Type EB3015	300 ohms, 5%, ½ watt
1	Signal Generator	Hewlett-Packard Model 608D	—
1	Signal Generator[2]	Measurements Model 65-B	—
1	Vacuum Tube Voltmeter	Ballantine Model 300	—
1	Vacuum Tube Voltmeter	Hewlett-Packard Model 410B	—
1	Voltmeter[1]	Weston Model 301	0-50 volts dc

[1] Required only if the low-voltage supply does not contain an output voltmeter and ammeter.
[2] Optional equipment; not required for alignment and adjustment procedures but useful for trouble-shooting.

If the transistor is a soldered-in type, remove the four screws fastening the printed-circuit board to the module frame and remove the printed-circuit board.

Caution

If the module also contains plug-in type transistors mounted on the module frame, carefully disengage the printed-circuit board from the module frame to avoid bending the plug-in transistor pins.

Remove the defective soldered-in transistor from the printed-circuit board and clean out the terminal eyelets. Run each lead of the replacement transistor through the eyelets of the printed-circuit board, observing polarity of each lead. Install the replacement transistor in the mounting clip provided and dress the leads as shown in the module wiring diagram. Cut off the excess length of each transistor lead projecting from the printed-circuit board. Solder each transistor lead to the printed-circuit board, holding the lead with pliers between the solder joint and the transistor to form a heat sink (to prevent excessive heat from damaging the transistor). Do not remove the pliers until the heat from the soldered joint has been dissipated. Use a small amount of solder to avoid excessive build-ups.

Replacement of Diodes. The R-33A contains four diodes: three are crystal diodes (one in A1 and two in A2) and one is a stud-mounted Zener diode located at the rear of chassis assembly A8. To replace a crystal diode in a module, remove the printed-circuit board from the module frame. Remove the defective diode from the printed-circuit board and clean out the terminal eyelets. Install the replacement diode, observing correct polarity, with its leads routed as nearly like the original installation as possible. Solder each diode lead to the printed-circuit board, holding the lead with pliers between the solder joint and the diode to form a heat sink (to prevent excessive heat from damaging the diode). Do not remove the pliers until the heat from the soldered joint has been dissipated. Use a small amount of solder to avoid excessive build-ups. Cut off the excess length of each diode lead projecting from the printed-circuit board.

To replace the stud-mounted Zener diode, A8CR1, unsolder the red wire from the top of the diode. Using a 7/16-inch open-end wrench, loosen the diode and unscrew it from its mounting block. To install the new diode, reverse the procedure.

Replacement of Crystals. The R-33A contains two subminiature crystals, A1Y1 and A1Y2, in r-f module A1. To replace either crystal, remove the printed-circuit board from the r-f module. Remove the defective crystal from the printed-circuit board and clean out the terminal eyelets. Install the replacement crystal so that the crystal pins just penetrate the thickness of the printed-circuit board. Solder each crystal pin to the printed-circuit board, holding the pin with pliers between the solder joint and the crystal to form a heat sink. Do not remove the pliers until the heat from the soldered joint has been dissipated. Use a small amount of solder to avoid excessive build-ups.

Replacement of Panel Lamps in C-83A Control Unit. The C-83A Control Unit uses five type 327 (28-volt) or 330 (14-volt) midget, flange-base panel lamps. To replace a lamp, proceed as follows:

Step 1. Unscrew and remove the lamp housing assembly.

Step 2. With the thin edge of a knife blade, or with the fingernails of the thumb and forefinger, inserted between the flange base of the lamp and threaded bushing, withdraw the defective lamp.

Step 3. Insert a new lamp, seating the flange of the base firmly against the threaded bushing.

Step 4. Replace the lamp housing assembly and screw in finger-tight.

5–4. R-33A RECEIVER TESTS.

General. Table 5–2 outlines procedures for checking the over-all performance of the R-33A. The test equipment required is listed in Table 5–1; the associated bench test interconnection diagram is shown in Figure 5–1.

Test Conditions. The following test conditions are used, unless otherwise specified:

Input voltage. 27.5 volts dc (for 28-volt operation) or 13.75 volts dc (for 14-volt operation) as measured on the test voltmeter.

Test Signal. Provided by Hewlett-Packard Model 608D Signal Generator adjusted as follows:

Frequency: 75 mc ±0.005%

Modulation: amplitude modulated 95% at 400 cps ±1%, 1300 cps ±1%, or 3000 cps ±1%, as specified

Output μv: hard microvolts,[1] as read directly on Model 608D attenuator dial, with the Model 608D output terminated by a 6-db attenuator (see Figure 5–1).

Audio Output Load. 300 ohms, non-inductive, as shown in Figure 5–1. (Parallel loads, such as a headset, must not be connected to the PHONE jack during audio output measurements.)

Warmup. Before making any measurements, allow the R-33A to warm up for at least 15 minutes with dust cover in place.

[1] Hard microvolts are defined as open-circuit microvolts across a 50-ohm signal source.

Receiver Test Precautions.

1. When adjusting the Hewlett-Packard Model 608D Signal Generator, or equivalent, or any of the five R-33A sensitivity controls, *always approach light operate threshold slowly in an increasing (clockwise) direction* to avoid mechanical backlash and lamp hysteresis effects.

2. During all test procedures, check the 75-mc calibration of the Model 608D frequently, using its internal crystal calibrator.

3. Always measure the R-33A audio output across a 300-ohm load, using an input signal modulated 95% *at 1300 cps only.*

4. Never adjust volume-level control A8R3, on the R-33A front panel, for an audio output greater than 8.66 volts ac (250 milliwatts) at 1300 cps as a higher level may cause false lighting at 3000 cps with 1300-cps high signal inputs.

5. Always make R-33A sensitivity measurements with the dust cover installed to avoid incorrect readings.

6. Before making any tests, depress each lamp cap of the bench-test indicating lights to check that the lamps are operative.

Definitions.

Light Operate Threshold. The value of increasing input signal which causes each of the three lamps to light: the blue light for 400-cps, the amber light for 1300-cps, and the white light for 3000-cps modulation.

Sensitivity. The magnitude of input signal which causes *light operate threshold.*

Lamp Operate Sensitivity (LOS). The magnitude of increasing input signal which causes the individual lamp in question to light.

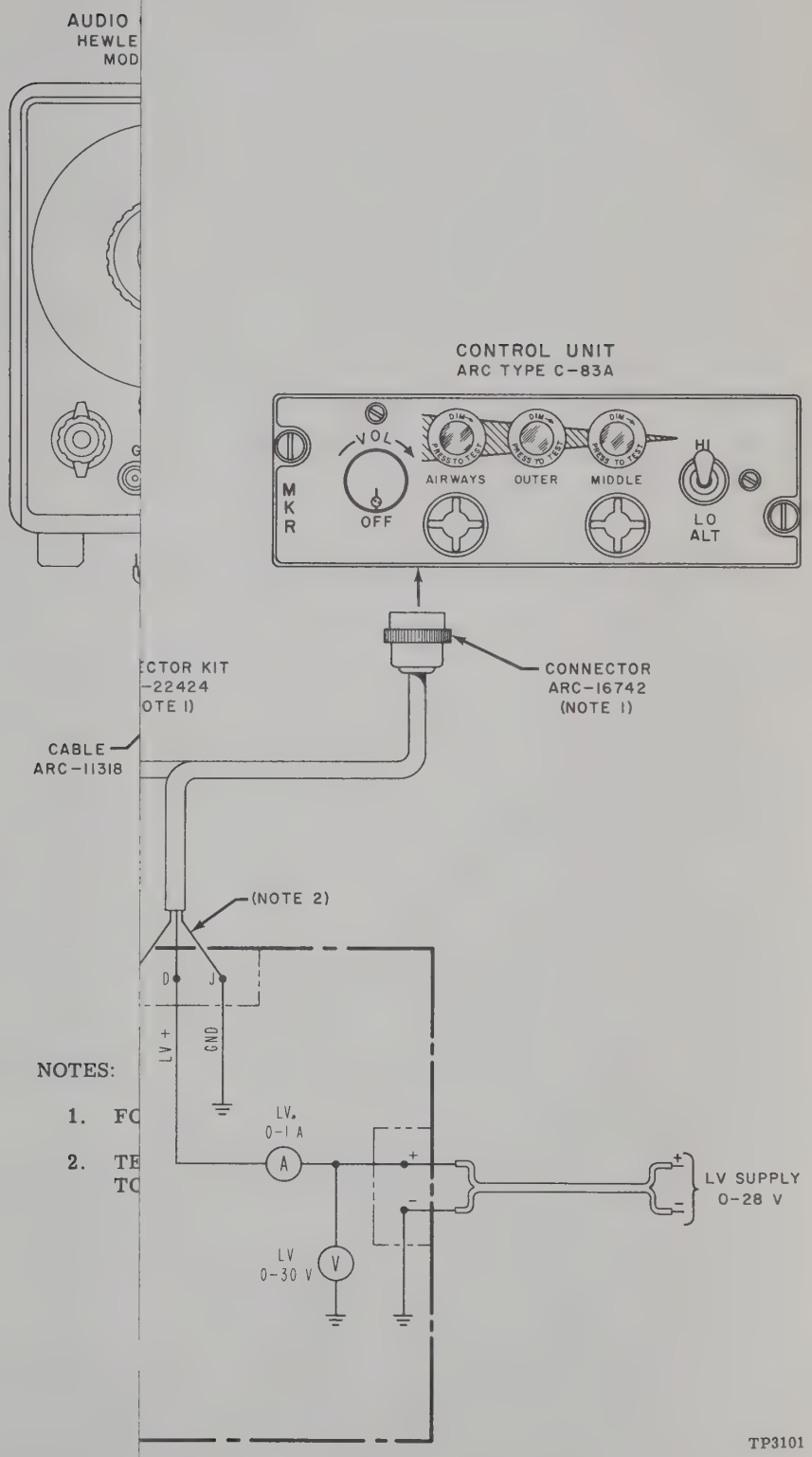
Low Lamp Operate Sensitivity. Lamp operate sensitivity with the receiver in the low-sensitivity condition.

False Lighting. The lighting of any lamp other than that desired with the receiver in the high-sensitivity condition.

Lamp Hysteresis Effect. The inherent characteristic of an R-33A lamp circuit which causes the lamp to go out at an input signal value lower than the light operate threshold value (similar to the operate-release characteristic of a relay).

TABLE 5–2. R-33A RECEIVER TESTS

Step	Procedure	Normal Indication
	PRELIMINARY PROCEDURE	
1	Interconnect equipment as shown in Figure 5–1.	None.
2	Set C-83A VOL-OFF control OFF (full counterclockwise).	None.
3	Apply primary power by turning C-83A VOL-OFF control clockwise. Adjust primary power supply to 13.75 or 27.5 volts dc, as read on d-c voltmeter, depending on cabling arrangement of bench test setup. Allow equipment to warm up for a minimum of 15 minutes, with R-33A dust cover installed.	D-c voltmeter reads as noted.
	SENSITIVITY AND AUDIO OUTPUT	
4	Using the crystal calibrator contained in the Hewlett-Packard 608D Signal Generator, tune the Model 608D to 75 mc. Adjust the Model 608D and the Hewlett-Packard Model 200AB Audio Oscillator for 95% modulation at 1300 cps.	As noted.
5	Set the C-83A HI-LO ALT (sensitivity) switch to LO. Starting with minimum r-f output from the Model 608D, slowly increase the output until the amber light on the C-83A lights. Record the r-f output.	Amber light should light at approximately 4000 μv (hard); minimum 3550 μv, maximum 4500 μv. **Note** The R-33A is factory-adjusted for 4000 μv (hard) on LO sensitivity. If the R-33A sensitivity adjustments were altered for a particular aircraft installation, substitute the known installation value.



NOTES:

1. FC
2. TE
TC

Figure 5–1. Bench Test Interconnection Diagram for R-33A Receiver

Receiver Test Precautions.

1. When adjusting the Hewlett-Packard Model 608D Signal Generator, or equivalent, or any of the five R-33A sensitivity controls, *always approach light operate threshold slowly in an increasing (clockwise) direction* to avoid mechanical backlash and lamp hysteresis effects.

2. During all test procedures, check the 75-mc calibration of the Model 608D frequently, using its internal crystal calibrator.

3. Always measure the R-33A audio output across a 300-ohm load, using an input signal modulated 95% *at 1300 cps only.*

4. Never adjust volume-level control A8R3, on the R-33A front panel, for an audio output greater than 8.66 volts ac (250 milliwatts) at 1300 cps as a higher level may cause false lighting at 3000 cps with 1300-cps high signal inputs.

5. Always make R-33A sensitivity measurements with the dust cover installed to avoid incorrect readings.

6. Before making any tests, depress each lamp cap of the bench-test indicating lights to check that the lamps are operative.

Definitions.

Light Operate Threshold. The value of increasing input signal which causes each of the three lamps to light: the blue light for 400-cps, the amber light for 1300-cps, and the white light for 3000-cps modulation.

Sensitivity. The magnitude of input signal which causes *light operate threshold.*

Lamp Operate Sensitivity (LOS). The magnitude of increasing input signal which causes the individual lamp in question to light.

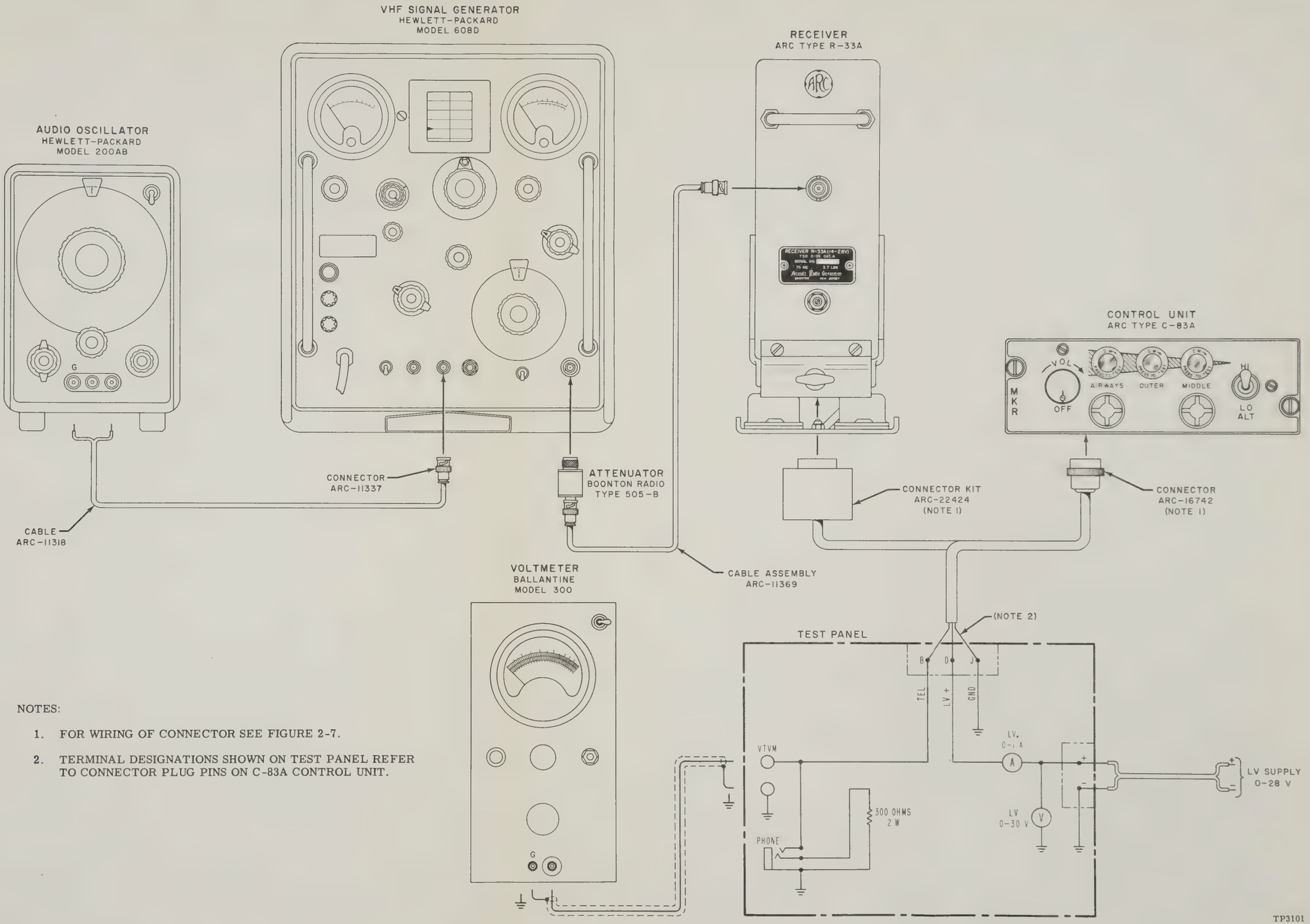
Low Lamp Operate Sensitivity. Lamp operate sensitivity with the receiver in the low-sensitivity condition.

False Lighting. The lighting of any lamp other than that desired with the receiver in the high-sensitivity condition.

Lamp Hysteresis Effect. The inherent characteristic of an R-33A lamp circuit which causes the lamp to go out at an input signal value lower than the light operate threshold value (similar to the operate-release characteristic of a relay).

TABLE 5–2. R-33A RECEIVER TESTS

Step	Procedure	Normal Indication
	PRELIMINARY PROCEDURE	
1	Interconnect equipment as shown in Figure 5–1.	None.
2	Set C-83A VOL-OFF control OFF (full counterclockwise).	None.
3	Apply primary power by turning C-83A VOL-OFF control clockwise. Adjust primary power supply to 13.75 or 27.5 volts dc, as read on d-c voltmeter, depending on cabling arrangement of bench test setup. Allow equipment to warm up for a minimum of 15 minutes, with R-33A dust cover installed.	D-c voltmeter reads as noted.
	SENSITIVITY AND AUDIO OUTPUT	
4	Using the crystal calibrator contained in the Hewlett-Packard 608D Signal Generator, tune the Model 608D to 75 mc. Adjust the Model 608D and the Hewlett-Packard Model 200AB Audio Oscillator for 95% modulation at 1300 cps.	As noted.
5	Set the C-83A HI-LO ALT (sensitivity) switch to LO. Starting with minimum r-f output from the Model 608D, slowly increase the output until the amber light on the C-83A lights. Record the r-f output.	Amber light should light at approximately 4000 μv (hard); minimum 3550 μv, maximum 4500 μv. **Note** The R-33A is factory-adjusted for 4000 μv (hard) on LO sensitivity. If the R-33A sensitivity adjustments were altered for a particular aircraft installation, substitute the known installation value.



NOTES:

1. FOR WIRING OF CONNECTOR SEE FIGURE 2-7.
2. TERMINAL DESIGNATIONS SHOWN ON TEST PANEL REFER TO CONNECTOR PLUG PINS ON C-83A CONTROL UNIT.

Figure 5–1. Bench Test Interconnection Diagram for R-33A Receiver

TABLE 5–2. R-33A RECEIVER TESTS — Continued

Step	Procedure	Normal Indication
	SENSITIVITY AND AUDIO OUTPUT — Continued	
6	Increase the Model 608D r-f output to ten times the output used in Step 5. Turn the C-83A VOL-OFF control fully clockwise. Measure the audio output voltage (used for the aircraft installation) on the Ballantine Model 300 Voltmeter and record the value for use in Step 12. Then adjust volume-level control A8R3 on the R-33A front panel for an output of 8.66 volts, as read on the Model 300.	As noted.
7	Reduce the Model 608D r-f output to a minimum and set the C-83A HI-LO ALT switch to HI. *Slowly* increase the r-f output until the amber light lights. Record the r-f output.	Amber light should light at approximately 1000 μv (hard); minimum 881 μv, maximum 1120 μv.
	Note The R-33A is factory-adjusted for 1000μv (hard) on HI sensitivity. If the R-33A sensitivity adjustments were altered during installation, substitute the known installation value.	
8	Repeat Step 5 at 400-cps modulation for the blue light.	As noted in Step 5, except using the blue light.
9	Repeat Step 7 at 400-cps modulation for the blue light.	As noted in Step 7, except using the blue light.
10	Repeat Step 5 at 3000-cps modulation for the white light.	As noted in Step 5, except using the white light.
11	Repeat Step 7 at 3000-cps modulation for the white light.	As noted in Step 7, except using the white light.
12	At 1300-cps modulation, repeat Step 6 to check that audio output voltage is at 8.66 volts, as read on the Ballantine Model 300. Then adjust the volume-level control on the R-33A front panel to obtain the audio output value (used for the aircraft installation) recorded in Step 6. Lock the volume-level control.	As noted.
	Note If the desired sensitivity is obtained for all three lights, no further checks are necessary. If sensitivity requires adjustment, refer to Table 5–4 for procedure.	

5–5. TROUBLE ANALYSIS.

Trouble-shooting Chart. Table 5–3 lists the symptoms of some possible troubles, their probable causes, and the suggested analysis procedures. To supplement this information, reference should be made to the circuit theory discussion in Section IV and to the R-33A schematic diagram, Figure 6–1.

Trouble-shooting Notes.

1. Use of a Measurements Model 65-B Signal Generator and a Tektronix Type 310 Oscilloscope, or their equivalents, is recommended to facilitate the trouble-shooting procedure.

2. To localize trouble quickly, replace a suspected module in the defective receiver with a good module from a spare R-33A Receiver.

3. When making resistance and continuity checks, disconnect one end of transistors, diodes, and low-voltage, tantalum electrolytic capacitors to avoid damaging the parts.

4. Before making any tests, check that the jumper plug is installed in oscillator test jacks TP1 and TP2 of the A1 module, otherwise the R-33A will exhibit very low sensitivity on all three modulating frequencies.

TABLE 5–3. R-33A RECEIVER TROUBLE-SHOOTING CHART

Symptom	Probable Cause	Analysis Procedure
Low receiver sensitivity on all three modulating frequencies.	Defective Zener diode A8CR1.	Check the 10-volt dc regulated supply voltage (pin O on chassis assembly A8 or insulated terminal on A8CR1). Voltage should be between 9.5 and 10.5 volts. If voltage is less than 9.5 volts, replace A8CR1.
	63.5-mc oscillator A1Q1 inoperative.	Check oscillator current as described in Steps 2 and 3 of *63.5-mc Oscillator Alignment* procedure in Table 5–4. If current is lower than 0.8 ma, realign the oscillator as described in Steps 4, 5, and 6 of the same procedure. Measure d-c voltages on A1Q1 per Table 5–5. Check A1Q1 and A1Y1.
	First mixer A1CR1, 11.5-mc filter A1Z2, or 75-mc filter A1Z1 defective.	Check oscillator current as described in Steps 2 and 3 of *63.5-mc Oscillator Alignment* procedure in Table 5–4. Increase r-f input signal to a high value and look for a slight increase in oscillator current. If no increase is observed, check A1CR1. If a Measurements Model 65-B Signal Generator, or equivalent, is available, tune the Model 65-B to 11.5 mc, 95% modulation at 400 cps. Connect the signal generator output through a .01-μf capacitor to base of A2Q1. With no 75-mc input to the R-33A, increase the 11.5-mc signal to determine if the 9.8-mc oscillator and the 1.7-mc i-f amplifier stages are operating. If satisfactory, connect the Model 65-B output to the input terminal of A1Z2 to check A1Z2. Check alignment of A1Z1 as described in *75-mc Filter Alignment* procedure given in Table 5–4.
	9.8-mc oscillator A1Q2 inoperative.	Measure d-c voltages on A1Q2 (refer to Table 5–5). Check A1Q2 and A1Y2. If a Model 65-B Signal Generator, or equivalent, is available, tune the Model 65-B to 9.8 mc, no modulation. Connect the signal generator output through a .01-μf capacitor to the base of A3Q1. With a 75-mc signal modulated 95% at 1300 cps connected to the R-33A, increase the 9.8-mc signal to determine if 1.7-mc filter A2Z1 and the i-f amplifier stages are operating, and to isolate the trouble to the 9.8-mc oscillator.
	Second mixer A2Q1 inoperative.	Check second mixer operation on both high and low sensitivities. If the second mixer is inoperative on high-sensitivity only, check A2CR1 and A2C4. If the mixer is inoperative on both sensitivities, check A2C1 and A2C3. Measure d-c voltages on A2Q1 (refer to Table 5–5). Check A2Q1.
	Agc stages A3Q1 and A3Q2 inoperative.	Check base voltages on A3Q1 and A3Q2 (refer to Table 5–5). If base voltage on A3Q1 is not correct, check emitter voltage on A4Q2. If emitter has proper voltage, check A2CR2 and A2C6. If base voltage of A3Q2 is incorrect, check collector voltage of A4Q2. Check A3C1, A3C2, A3C3, A3C5, and A3C6. Check voltages on A4Q1 and A4Q2 (refer to Table 5–5) and check the transistors. Check A4C1, A4C2, and A4C3.

TABLE 5–3. R-33A RECEIVER TROUBLE-SHOOTING CHART — Continued

Symptom	Probable Cause	Analysis Procedure
(Continued)	1.7-mc i-f amplifier stages inoperative.	Make transistor voltage measurements in module A3 (refer to Table 5–5). If a Measurements Model 65-B Signal Generator, or equivalent, is available, tune the signal generator to 1.7 mc, 95% modulation at 400 cps. Connect the signal generator output through a .01-μf capacitor to the collector of A2Q1. With no 75-mc input to the R-33A, increase the 1.7-mc signal to determine if 1.7-mc filter A2Z1 and i-f amplifier stages are operating. If they are not operating, make a point-to-point check of each i-f amplifier to isolate the defective stage.
	Amplifying detector A4Q3 or first a-f amplifier A4Q4 inoperative.	If a Measurements Model 65-B Signal Generator, or equivalent, is available, tune the signal generator to 1.7 mc, 95% modulation at 400 cps. Connect the Model 65-B output through a .01 μf capacitor to the base of A4Q3 and, with no 75-mc signal input to the R-33A, increase the 1.7-mc signal to determine if A4Q3 and A4Q4 are operating. Adjust the frequency of Hewlett-Packard Model 200AB Audio Oscillator to 1300 cps and connect the output through a .01-μf capacitor to the base of A4Q3 to determine if audio section is operating. (To avoid distortion, do not use an audio input greater than 1.0 volt ac.) If it is inoperative, connect the Model 200AB output to the collector of A4Q3 to isolate trouble. Measure voltages on A4Q3 and A4Q4 (refer to Table 5–5). Check A4Q3 and A4Q4.
Lamp modules operate properly but audio output is defective.	Defective audio output.	Check setting of volume-level control A8R3 on R-33A front panel. Make voltage measurements on transistors A4Q4, A4Q5, and A4Q6 (refer to Table 5–5). Check A4C8 for possible short.
Sufficient audio output but one lamp module inoperative.	Defective lamp module.	Check lamp associated with defective lamp module by depressing lamp cap. Make voltage measurements on each transistor in the lamp module (refer to Table 5–5). Adjust Hewlett-Packard Model 200AB Audio Oscillator to correct modulation frequency for the defective unit and connect the output through a .01 μf capacitor to pin U on chassis assembly A8. Turn sensitivity control R1 of defective module fully clockwise. If a large audio signal is required to operate the associated lamp, check R11. If no lamp operation is obtained, connect the Model 200AB output to the emitter of Q2, then to the base of Q2, and then to the base of Q1 to isolate the trouble.
False lighting (two or three lamps light simultaneously).	Distortion in audio circuits.	Check the setting of volume-level control A8R3 on R-33A front panel as described in Step 6 in Table 5–2. If an audio output of greater than 8.66 volts is used, the resulting audio distortion may cause false lighting of the white light for high 1300-cps signal imputs.

TABLE 5–3. R-33A RECEIVER TROUBLE-SHOOTING CHART — Continued

Symptom	Probable Cause	Analysis Procedure
(Continued)	(Continued)	If a Tektronix Type 310 Oscilloscope, or equivalent, is available, connect the oscilloscope probe to the emitter of A4Q4 and check for audio distortion.
One or more lamps glow dimly, regardless of input signal strength or modulating frequency.	Defective transistor Q5 in lamp module A5, A6, or A7.	Measure d-c voltage on collector of Q4 (same as base of Q5) on defective lamp module. If the voltage observed is greater than 0.10 volts, it indicates excessive leakage in the Q5 transistor. *Replace Q5 with an ARC-22441 transistor only.*
Very high sensitivity as indicated by high background noise in audio output, blinking lamp on light operate threshold, and false lighting at high input signal levels.	Defective Zener diode A8CR1.	Check the 10-volt regulated supply voltage (pin O on chassis assembly A8 or insulated terminal on A8CR1). Voltage should be between 9.5 and 10.5 volts. If voltage is greater than 10.5, A8CR1 is defective and should be replaced.

5–6. R-33A ALIGNMENT AND ADJUSTMENT.

General. Table 5–4 outlines the procedures for aligning and adjusting the R-33A Receiver. Each procedure may be performed independently of the other. The test equipment required is listed in Table 5–1 and the bench test setup is shown in Figure 5–1. The test conditions, precautions, and definitions listed in paragraph 5–4 are also applicable. Alignment and adjustment points for the R-33A are shown in Figure 5–2.

Alignment and Adjustment Precautions.

1. A dummy dust cover with access holes for sensitivity adjustments is required for the alignment and adjustment procedures (see Figure 5–3).
2. When adjusting the low- and high-sensitivity controls, as described in Steps 6 through 9 of the *Sensitivity* procedure, always adjust the low-sensitivity control *first,* as the high-sensitivity adjustment is dependent on the setting of the low-sensitivity control.

TABLE 5–4. ALIGNMENT AND ADJUSTMENT PROCEDURES

Step	Procedure	Normal Indication
	PRELIMINARY PROCEDURE	
1	Interconnect equipment as shown in Figure 5–1.	None.
2	Remove dust cover from R-33A and install dummy dust cover shown in Figure 5–3. **Note** The dummy dust cover must be installed for all adjustments given in this procedure.	None.
3	Set C-83A VOL-OFF control OFF (full counterclockwise).	None.
4	Apply primary power by turning C-83A VOL-OFF control clockwise. Adjust primary power supply to 13.75 or 27.5 volts dc, as read on d-c voltmeter, depending on cabling arrangement of bench test setup. Allow equipment to warm up for a minimum of 15 minutes.	D-c voltmeter reads as noted.
5	Using a socket wrench, loosen the locknuts on the five internal controls in the R-33A (see Figure 5–2). Using a screwdriver, turn each internal control to its maximum clockwise position. Do not disturb the front panel volume-level control.	None.
	63.5-MC OSCILLATOR ALIGNMENT	
1	Perform the preliminary procedure outlined previously in this table.	None.

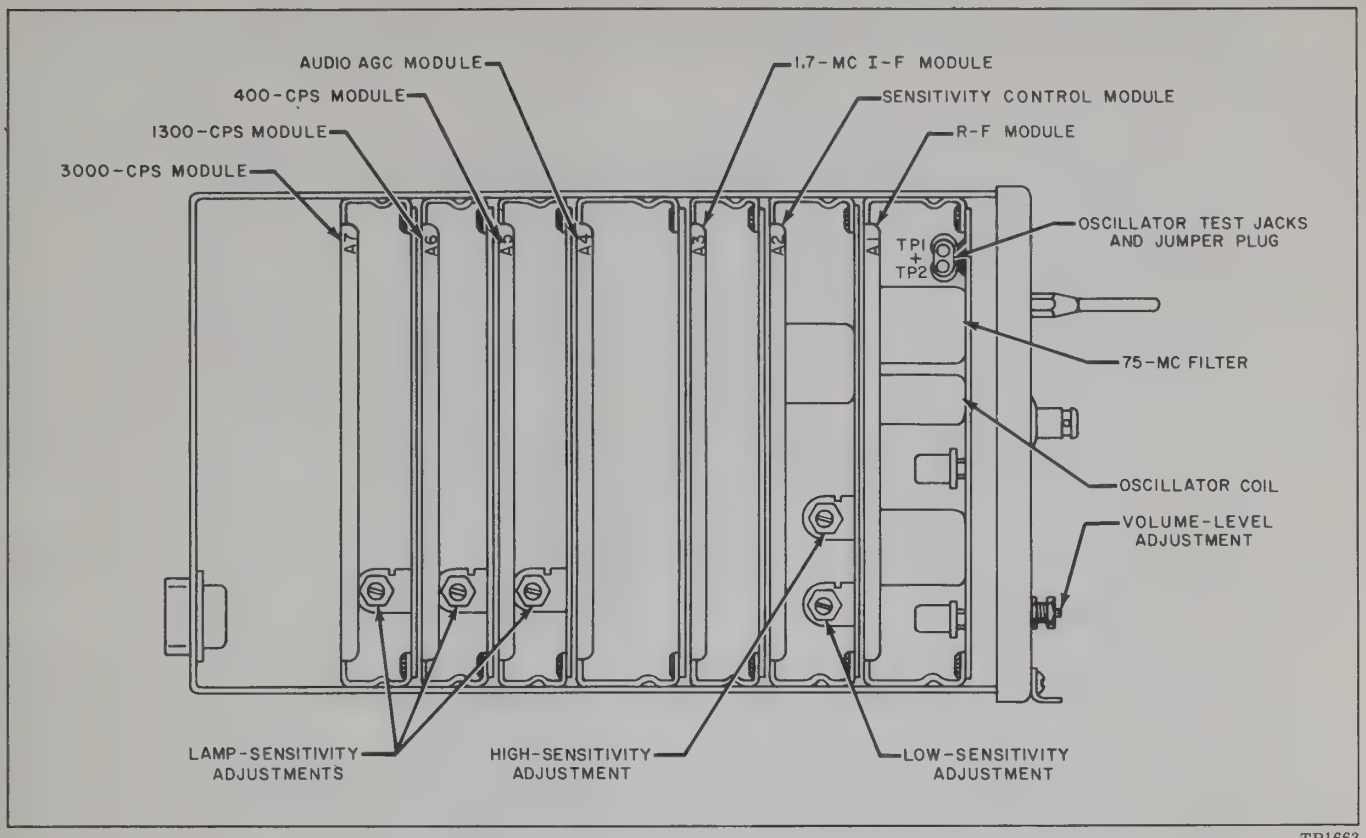


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Figure 5–2. R-33A Receiver, Alignment and Adjustment Points

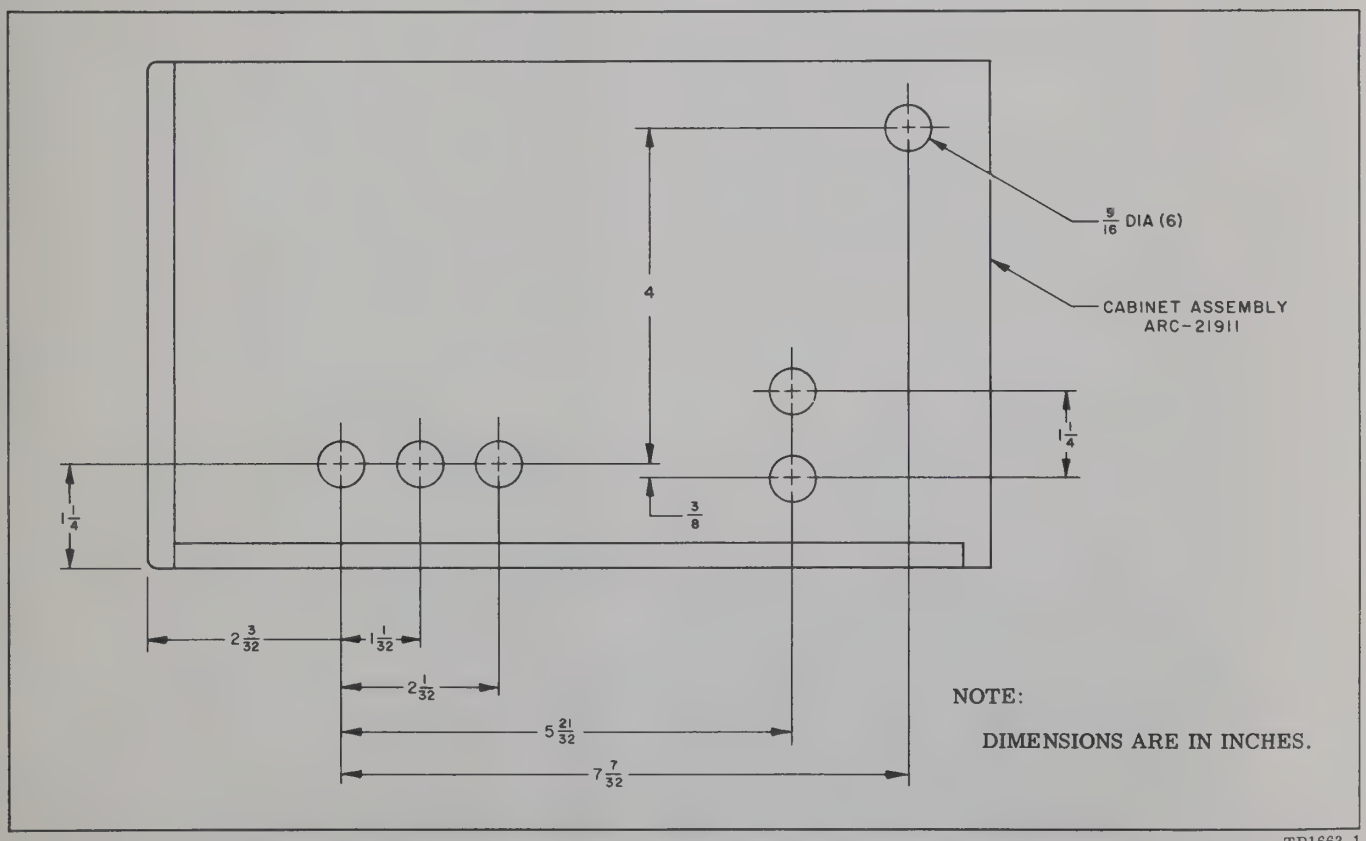

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Figure 5–3. Dummy Dust Cover for Alignment and Adjustment Procedures

TABLE 5–4. ALIGNMENT AND ADJUSTMENT PROCEDURES — Continued

Step	Procedure	Normal Indication
	63.5-MC OSCILLATOR ALIGNMENT — Continued	
2	Turn primary power off. Remove jumper plug P1 from oscillator test jacks TP1 and TP2 in the R-33A (see Figure 5–2) and connect a Weston Model 301 Milliammeter (0-5 ma), or equivalent, in place of jumper. Connect positive terminal of meter to outer test jack TP1. Reapply primary power.	None.
3	With no r-f signal input, observe the reading on the milliammeter. If the reading is greater than 0.8 ma, the oscillator is functioning normally and no adjustment is required; proceed with Step 5. If the reading is less than 0.8 ma, proceed with Steps 4 and 5.	Milliammeter reads as noted.
4	Turn primary power off. Using a No. 4 Bristol wrench, loosen the two setscrews on the R-33A handle assembly and remove the handle. Remove the two screws which secure the handle sockets to the front panel. Remove the two screws which secure the mounting flange to the bottom of the front panel. Remove the locknut on the volume-level control, and remove the nut and lockwasher which secure the control to the front panel. Carefully remove the front panel to expose the oscillator adjustment and the 75-mc filter adjustment holes. Temporarily secure the volume-level control to the front chassis frame, using the nut and lockwasher. Reapply primary power.	None.
5	Align the 63.5-mc oscillator by adjusting the slug of oscillator coil A1T1 until maximum deflection occurs on the milliammeter and note the reading. Back the slug out (counterclockwise rotation) until the meter reads approximately 70.7% of the peak indication.	As noted.
6	Turn primary power off. Disconnect the milliammeter from the oscillator test jacks and replace the jumper. **Note** If the front panel was removed to tune the oscillator, do not replace the panel if the 75-mc filter is to be aligned.	None.
	75-MC FILTER ALIGNMENT	
	Note The 75-mc filter assembly, A1Z1, is factory-adjusted and normally does not require any further adjustment. No alignment of the filter should be made unless the receiver tests listed in Table 5–2 are unsatisfactory and no other cause can be determined.	
1	Perform the preliminary procedure outlined previously in this table.	None.
2	Remove the front panel as described in Step 4 of the *63.5-mc Oscillator Alignment* procedure in this table.	None.
3	Using the crystal calibrator contained in the Hewlett-Packard Model 608D Signal Generator, tune the Model 608D to 75 mc. Adjust the Model 608D and the Hewlett-Packard Model 200AB Audio Oscillator for 95% modulation at 1300 cps.	As noted.
4	Set the C-83A HI-LO ALT switch to LO. Starting with minimum r-f output from the Model 608D, *slowly* increase the output until the amber light lights. Note the audio output on the Ballantine Model 300. Keeping the output signal level of the Model 608D below that which causes the amber light to light (to avoid agc action), adjust each of the three tuning slugs of A1Z1 for maximum indication on the Model 300. Start with the slug nearest the antenna input and adjust the slugs in the following order: 1, 2, 3, 1, 2.	As noted.
5	Turn primary power off and replace the front panel, mounting flange, and handle.	None.

TABLE 5–4. ALIGNMENT AND ADJUSTMENT PROCEDURES — Continued

Step	Procedure	Normal Indication
	SENSITIVITY ADJUSTMENT	
1	Perform the preliminary procedure outlined previously in this table.	None.
2	Using the crystal calibrator contained in the Hewlett-Packard Model 608D Signal Generator, tune the Model 608D to 75 mc. Adjust the Model 608D and the Hewlett-Packard Model 200AB Audio Oscillator for 95% modulation at 1300 cps.	As noted.
3	Set the C-83A HI-LO ALT switch to LO. Starting with minimum r-f output from the Model 608D, slowly increase the output until the amber light lights. Record the r-f output.	As noted.
4	Increase the Model 608D r-f output to ten times the output used in Step 3 of this procedure. Turn C-83A VOL-OFF control fully clockwise. Measure the audio output voltage (used for the aircraft installation) on the Ballantine Model 300 Voltmeter and record the value for use in Step 10. Then adjust the volume-level control on the R-33A front panel for an output of 8.66 volts across 300 ohms, as read on the Model 300.	As noted.
5	Reduce Model 608D r-f output to a minimum and adjust the Model 608D and the Model 200AB audio oscillator for 95% modulation at 3000 cps. *Slowly* increase the r-f output until the white light just lights. Note the db reading on the Model 300. Then increase the r-f output to the maximum and read the increase in output in db on the Model 300. If the increase is within the limits of 4.5 to 9 db (6 db is typical), lock the lamp-sensitivity control on 3000-cps module A7 in its existing position (full clockwise). If the increase is greater than 9 db, note the maximum reading on the Model 300, then slowly reduce the r-f output until the reading on the Model 300 is 6 db below the maximum reading (the white light will still be lighted). Slowly turn the lamp-sensitivity control on 3000-cps module A7 counterclockwise until the light goes out. Reduce the r-f output to a minimum, then slowly increase the r-f output to check that the white light will light at the 6 db-below-maximum reading on the Model 300. If necessary, make further slight adjustments in the setting of the lamp-sensitivity control to obtain the desired threshold. Lock the 3000-cps lamp-sensitivity control.	As noted.
6	With the C-83A HI-LO ALT switch in the LO position, set the Model 608D r-f output to 4000 μv. **Note** LO sensitivity of 4000 μv is the standard factory adjustment value. If some other value is desired for a particular installation, set the r-f output to this value. Adjust the low-sensitivity control on the A2 module so that the white light lights for the 4000-μv (or other desired value) output of the Model 608D. Check the setting by reducing the r-f output and then slowly approaching light threshold. Lock the low-sensitivity control.	As noted.
7	Adjust the Model 608D and Model 200AB for 95% modulation at 400 cps and an output of 4000 μv (or other desired value). Adjust the lamp-sensitivity control on 400-cps module A5 for light operate threshold (blue light). Lock the control.	As noted.
8	Adjust the Model 608D and Model 200AB for 95% modulation at 1300 cps and an output of 4000 μv (or other desired value). Adjust the lamp-sensitivity control on 1300-cps module A6 for light operate threshold (amber light). Lock the control.	As noted.

TABLE 5–4. ALIGNMENT AND ADJUSTMENT PROCEDURES — Continued

Step	Procedure	Normal Indication
	SENSITIVITY ADJUSTMENT — Continued	
9	Reduce the Model 608D r-f output to a minimum and set the C-83A HI-LO ALT switch to HI. Using 95% modulation at 1300 cps, set the Model 608D r-f output to 1000 μv. **Note** HI sensitivity of 1000 μv is the standard factory adjustment value. If some other value is desired for a particular installation, set the r-f output to this value. Adjust the high-sensitivity control on the A2 module so that the amber light just lights for the 1000-μv (or other desired value) output of the Model 608D. Check the setting by reducing the r-f output and then slowly approaching light threshold. Lock the high-sensitivity control.	As noted.
10	Increase the Model 608D r-f output to ten times the output used in Step 9 of this procedure. Read the audio output voltage on the Model 300. The reading should be 8.66 volts, the same value as that established in Step 4. Then adjust the volume-level control on the R-33A front panel to obtain the audio output value (used for the aircraft installation) recorded in Step 3.	As noted.
11	Reduce Model 608D r-f output to a minimum and adjust the Model 608D and Model 200AB for 95% modulation at 400 cps. Slowly increase the r-f output to check the light operate threshold for the blue light. The lamp should light for 1000-μv signal generator output.	As noted.
12	Repeat Step 11 for 3000-cps modulation (white light). White light should light for 1000-μv signal generator output.	As noted.
13	Disconnect the R-33A and replace the dummy dust cover with the original dust cover.	None.

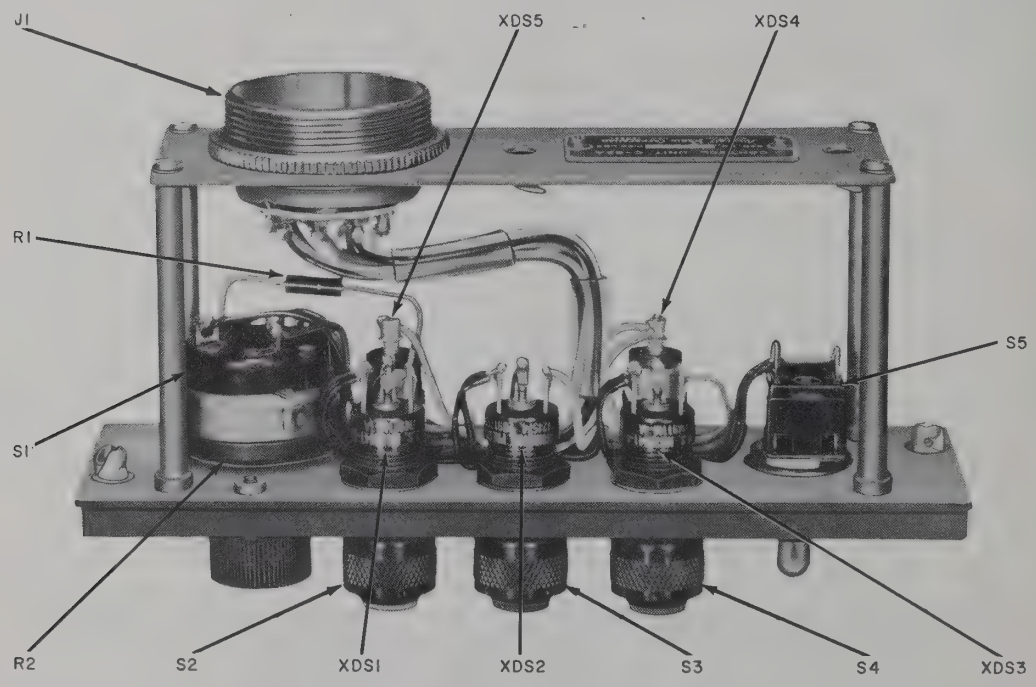

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Figure 5–4. C-83A Control Unit, Interior View

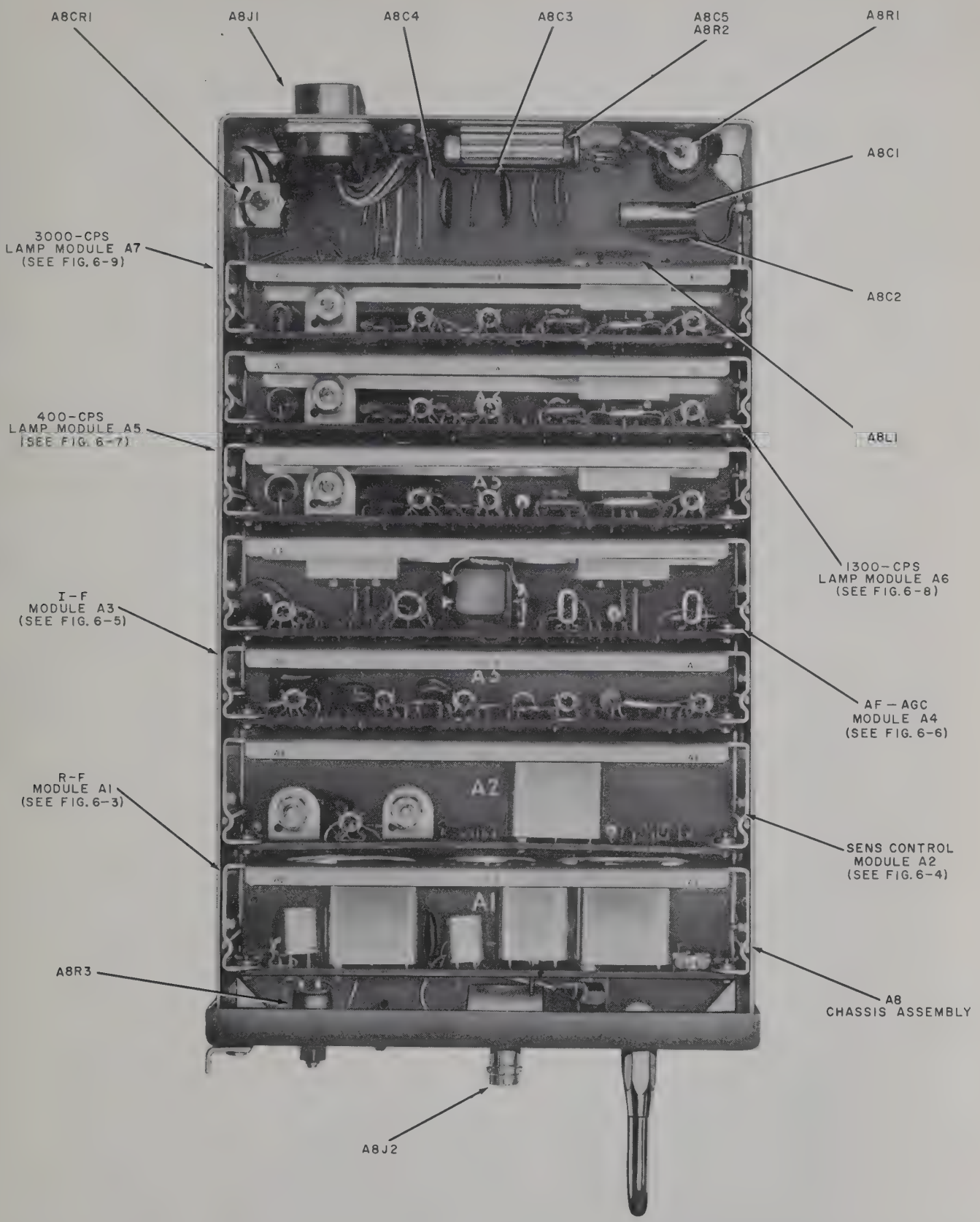

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Figure 5–5. R-33A Receiver, Left Interior View

5–7. R-33A MEASUREMENTS.

Table 5–5 lists typical input and transistor voltage measurements for the R-33A Marker Beacon Receiver. The measurements were made under the conditions noted in the table.

TABLE 5–5. R-33A INPUT AND VOLTAGE MEASUREMENTS

Conditions:

1. Equipment connected as shown in Figure 5–1. Test conditions described in paragraph 5–4 and preliminary procedure outlined in Table 5–2 also apply.
2. Input voltage and current measurements made with meters installed in bench test setup (see Figure 5–1).
3. Input current for maximum signal measured for 200,000 hard microvolts r-f signal, 95% modulation at 1300 cps, with volume-level control A8R3 set for an audio output of 8.66 volts across 300 ohms (250 mw).
4. All transistor voltage measurements made with vacuum tube voltmeter such as Hewlett-Packard Model 410B, or equivalent. Voltages are positive dc and are measured with respect to chassis ground, unless otherwise noted. Voltages measured for no-signal input condition.
5. Voltages shown in parentheses are for 14-volt operation.

INPUT MEASUREMENTS

Input	*No Signal*	*Maximum Signal*[1]
LV Voltage	27.5 (13.75) volts dc	27.5 (13.75) volts dc
LV Current	380 (350) ma dc	515 (450)[2] ma dc

TRANSISTOR VOLTAGES

Test Point	*A1 Module*		*A2 Module*	*A3 Module*				
	Q1 (2N384)	*Q2 (2N274)*	*Q1 (2N274)*	*Q1 (2N274)*	*Q2 (2N274)*	*Q3 (2N274)*	*Q4 (2N274)*	*Q5 (2N274)*
E	9.3	9.2	5.1	4.9	5.4	5.1	9.3	9.2
B	9.0	9.1	4.8	4.6	5.2	4.8	9.1	8.9
C	0	0	0	0	0.29	[3]0.30	0	0
S	0	0	0	0	0	0	0	0

	A4 Module						
	Q1 (904)	*Q2 (904)*	*Q3 (2N274)*	*Q4 (2N270)*	*Q5 (2N1183A)*	*Q6 (2N1183A)*	*Q7 (2N647)*
E	0.10	4.9	8.7	8.2	27.5 (13.75)	27.5 (13.75)	0
B	0	5.6	8.5	9.1	27.2 (13.6)	27.3 (13.6)	0
C	5.5	5.2	4.0	0	0.78	0.61	9.1
S	—	—	—	—	—	—	—

	A5, A6, or A7 Module				
	Q1 (2N217)	*Q2 (2N217)*	*Q3 (2N647)*	*Q4 (2N217)*	*Q5 (ARC-22441)*
E	9.1	5.6	1.03	8.5	0.13
B	8.9	5.4	0.74	9.8	0.25
C	5.5	0	9.8	0.25	27.5 (13.75)
S	—	—	—	—	—

[1] Measured at 400 cps, 95% modulation, 200,000 hard μv.
[2] Includes 40-ma current drain of 28-volt Type 327 lamp used in bench test setup. If a different lamp is used, current drain will vary accordingly.
[3] Value will vary depending on value of A3R9 installed at time of final installation (see Figure 6–1, Note 6).

SECTION VI

DIAGRAMS

Figure 6–1. R-33A Receiver, Schematic Diagram

Figure 6–2. R-33A Receiver, Chassis Wiring Diagram

Figure 6–3. R-f Module A1, Wiring Diagram

Figure 6–4. Sensitivity Control Module A2, Wiring Diagram

Figure 6–5. I-f Module A3, Wiring Diagram

Figure 6–6. Af-Agc Module A4, Wiring Diagram

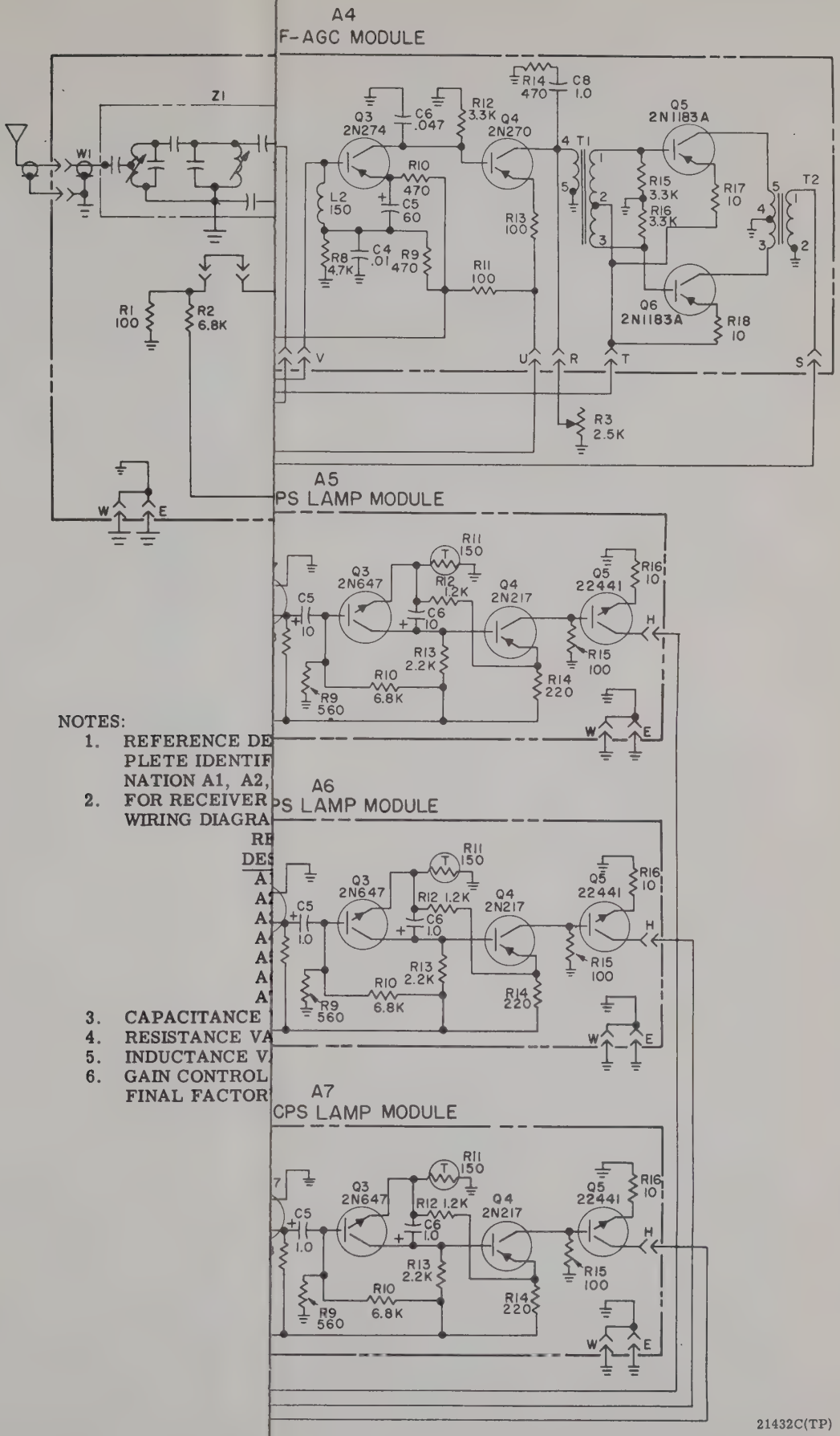
Figure 6–7. 400-cps Lamp Module A5, Wiring Diagram

Figure 6–8. 1300-cps Lamp Module A6, Wiring Diagram

Figure 6–9. 3000-cps Lamp Module A7, Wiring Diagram

Figure 6–10. C-83A Control Unit, Schematic Diagram

Figure 6–11. C-83A Control Unit, Wiring Diagram



NOTES:

1. REFERENCE DE
PLETE IDENTIF
NATION A1, A2,
2. FOR RECEIVER
WIRING DIAGRA
RE
DES
A1
A2
A3
A4
A5
A6
A7
3. CAPACITANCE
4. RESISTANCE VA
5. INDUCTANCE V
6. GAIN CONTROL
FINAL FACTOR

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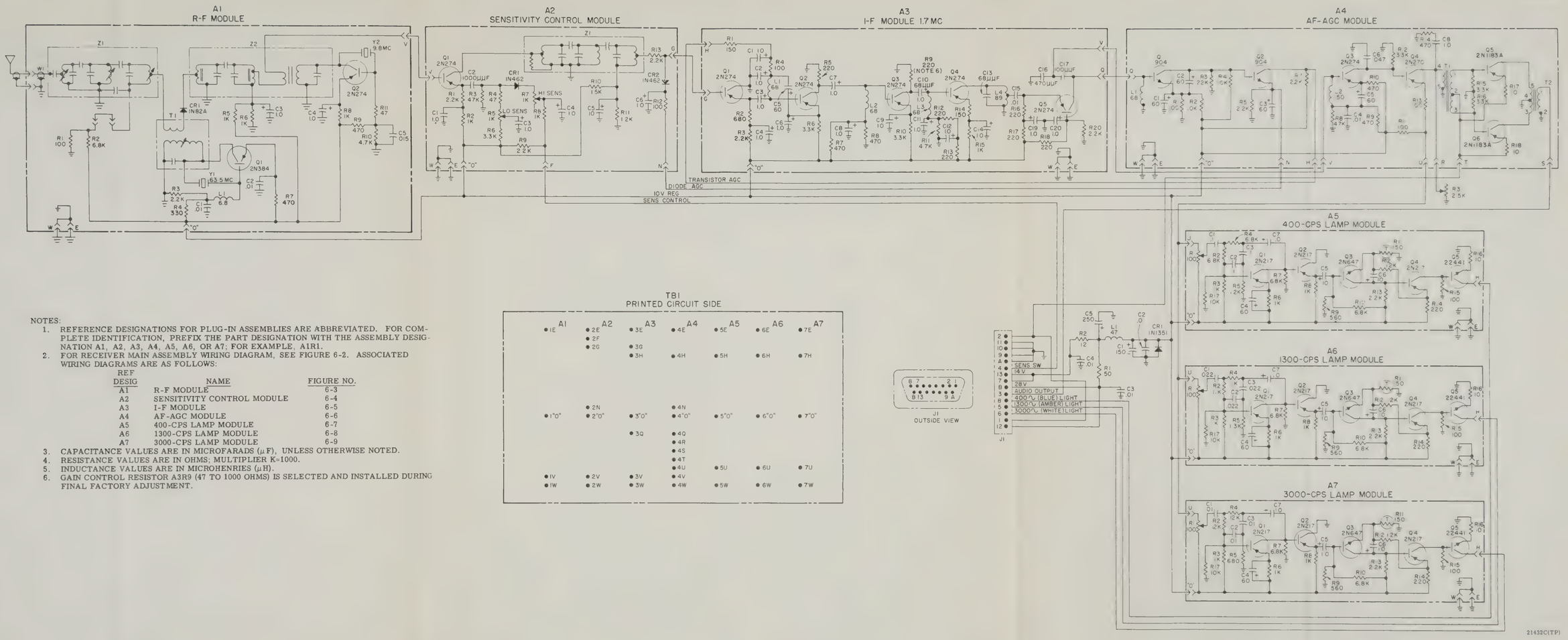
Figure 6–1. R-33A Receiver, Schematic Diagram



TB1
PRINTED CIRCUIT SIDE

	A1	A2	A3	A4	A5	A6	A7
	1E	2E	3E	4E	5E	6E	7E
		2F					
		2G	3G				
			3H	4H	5H	6H	7H
		2N		4N			
	1"0"	2"0"	3"0"	4"0"	5"0"	6"0"	7"0"
			3Q	4Q			
				4R			
				4S			
				4T			
				4U	5U	6U	7U
	1V	2V	3V	4V			
	1W	2W	3W	4W	5W	6W	7W

NOTES:

1. REFERENCE DESIGNATIONS FOR PLUG-IN ASSEMBLIES ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION A1, A2, A3, A4, A5, A6, OR A7; FOR EXAMPLE, A1R1.
2. FOR RECEIVER MAIN ASSEMBLY WIRING DIAGRAM, SEE FIGURE 6-2. ASSOCIATED WIRING DIAGRAMS ARE AS FOLLOWS:

REF DESIG	NAME	FIGURE NO.
A1	R-F MODULE	6-3
A2	SENSITIVITY CONTROL MODULE	6-4
A3	I-F MODULE	6-5
A4	AF-AGC MODULE	6-6
A5	400-CPS LAMP MODULE	6-7
A6	1300-CPS LAMP MODULE	6-8
A7	3000-CPS LAMP MODULE	6-9

3. CAPACITANCE VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE NOTED.
4. RESISTANCE VALUES ARE IN OHMS; MULTIPLIER K=1000.
5. INDUCTANCE VALUES ARE IN MICROHENRIES (μH).
6. GAIN CONTROL RESISTOR A3R9 (47 TO 1000 OHMS) IS SELECTED AND INSTALLED DURING FINAL FACTORY ADJUSTMENT.

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Figure 6–1. R-33A Receiver, Schematic Diagram

NOTES:

1. FOR SCHEMAT

2. ASSOCIATED W

REF DESIG	
A1	R-F
A2	SENS
A3	I-F
A4	AF-A
A5	400-
A6	1300
A7	3000

3. WIRES MARKE
COPPER, TEF
NO. 24 BARE,

4. SHADED AREA
SIDE OF BOAR

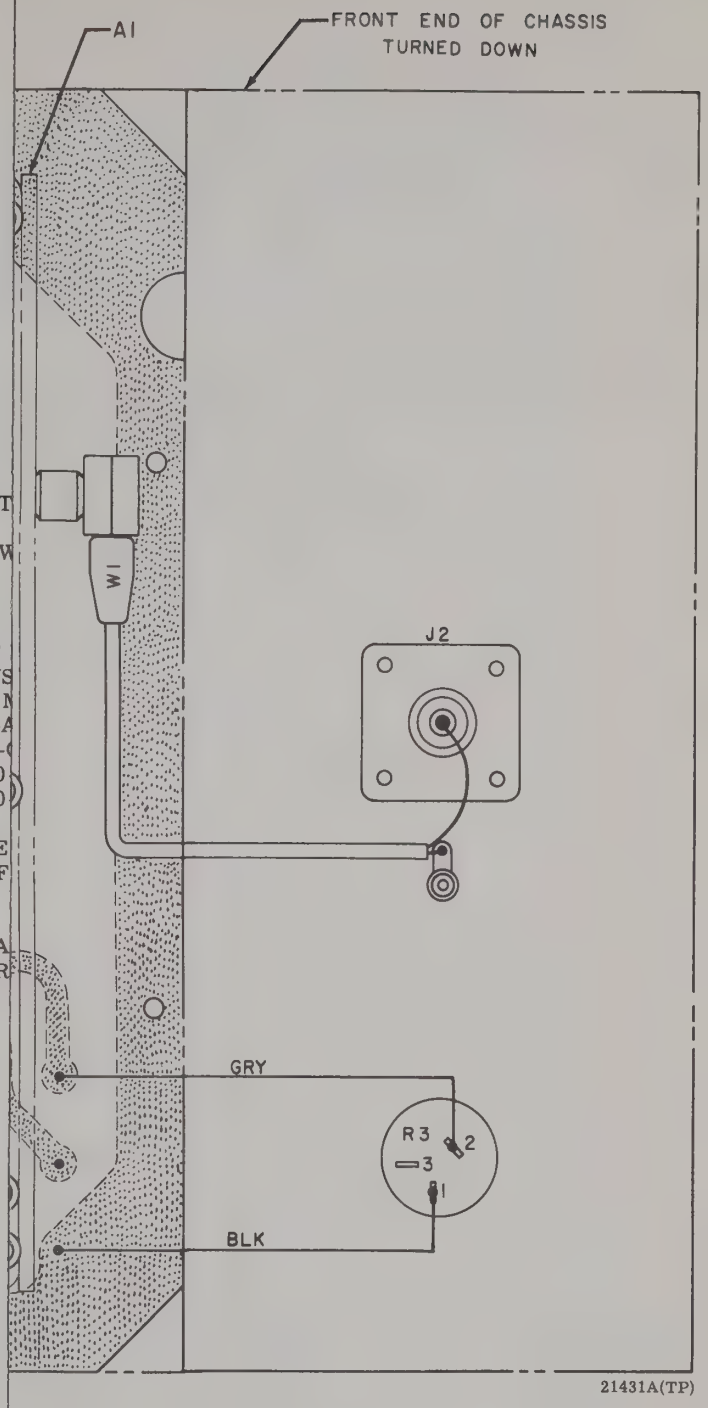


Figure 6–2. R-33A Receiver, Chassis Wiring Diagram

NOTES:

1. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.
2. ASSOCIATED WIRING DIAGRAMS ARE AS FOLLOWS:

REF DESIG	NAME	FIGURE NO.
A1	R-F MODULE	6-3
A2	SENSITIVITY CONTROL MODULE	6-4
A3	I-F MODULE	6-5
A4	AF-AGC MODULE	6-6
A5	400-CPS LAMP MODULE	6-7
A6	1300-CPS LAMP MODULE	6-8
A7	3000-CPS LAMP MODULE	6-9

3. WIRES MARKED WITH COLOR NOTE ARE NO. 24 STRANDED COPPER, TEFLON INSULATED. UNMARKED WIRES ARE NO. 24 BARE, SOLID, TINNED COPPER.
4. SHADED AREA DENOTES UNETCHED COPPER ON OPPOSITE SIDE OF BOARD.

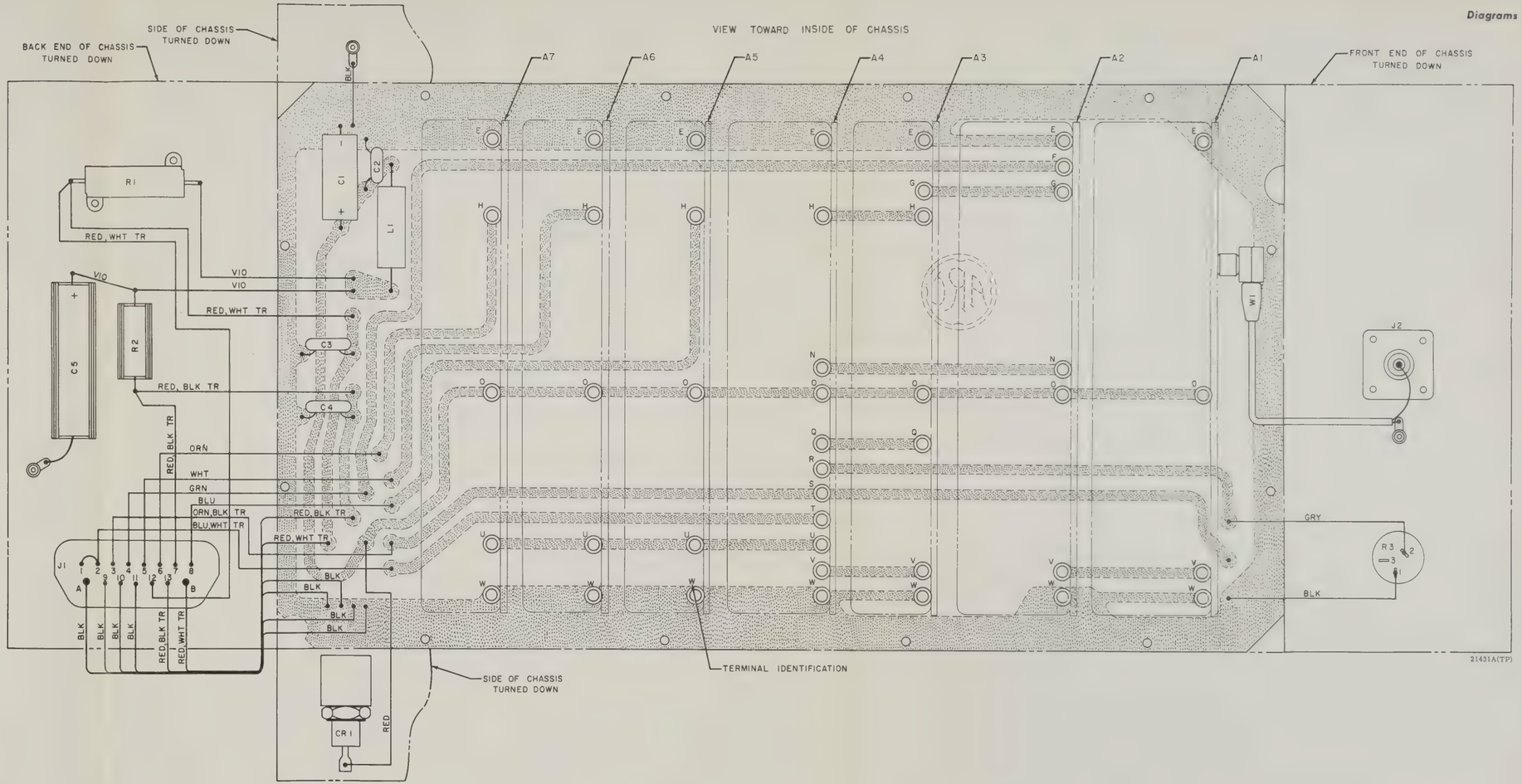
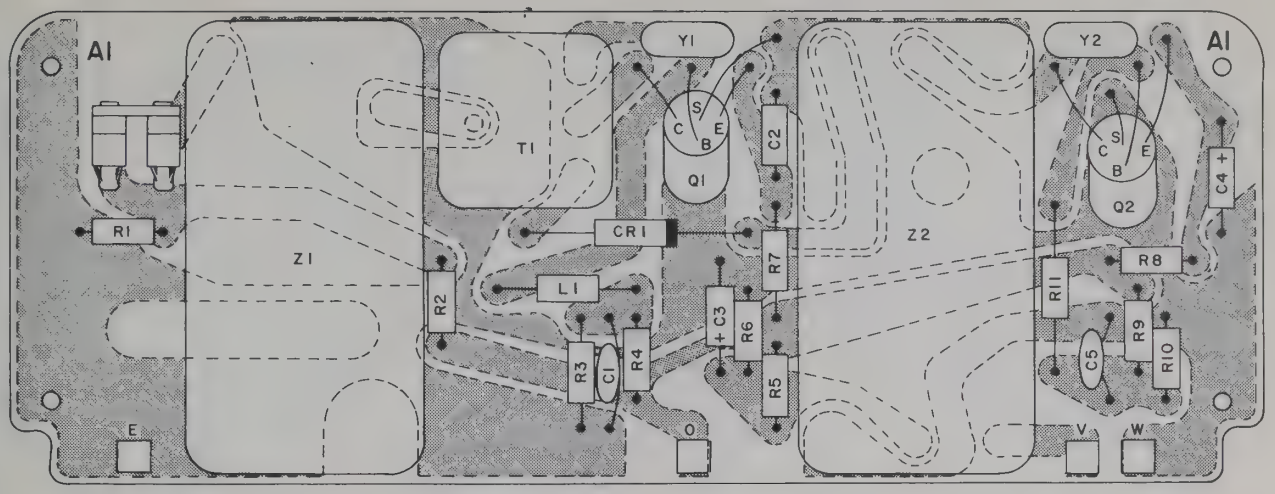


Figure 6–2. R-33A Receiver, Chassis Wiring Diagram



NOTES:

1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE MODULE DESIGNATION, A1; FOR EXAMPLE, A1C5.
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.
3. FOR CHASSIS WIRING DIAGRAM, SEE FIGURE 6-2.
4. SHADED AREA DENOTES UNETCHED COPPER ON OPPOSITE SIDE OF BOARD.

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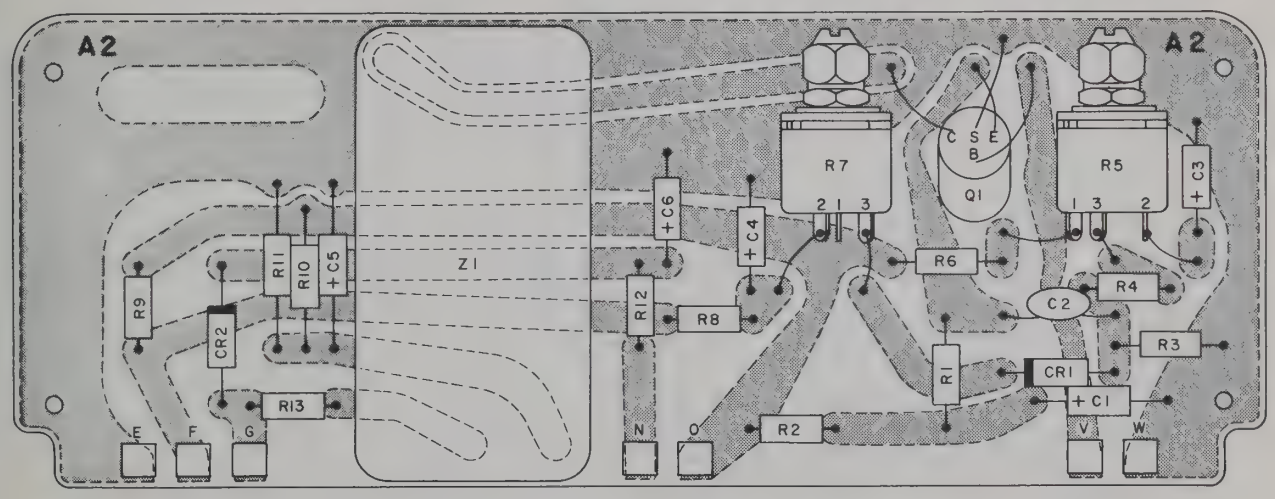
Figure 6–3. R-f Module A1, Wiring Diagram



NOTES:

1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE MODULE DESIGNATION, A2; FOR EXAMPLE, A2C6.
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.
3. FOR CHASSIS WIRING DIAGRAM, SEE FIGURE 6-2.
4. UNMARKED WIRES ARE NO. 24 AWG BARE, SOLID, TINNED COPPER.
5. SHADED AREA DENOTES UNETCHED COPPER ON OPPOSITE SIDE OF BOARD.

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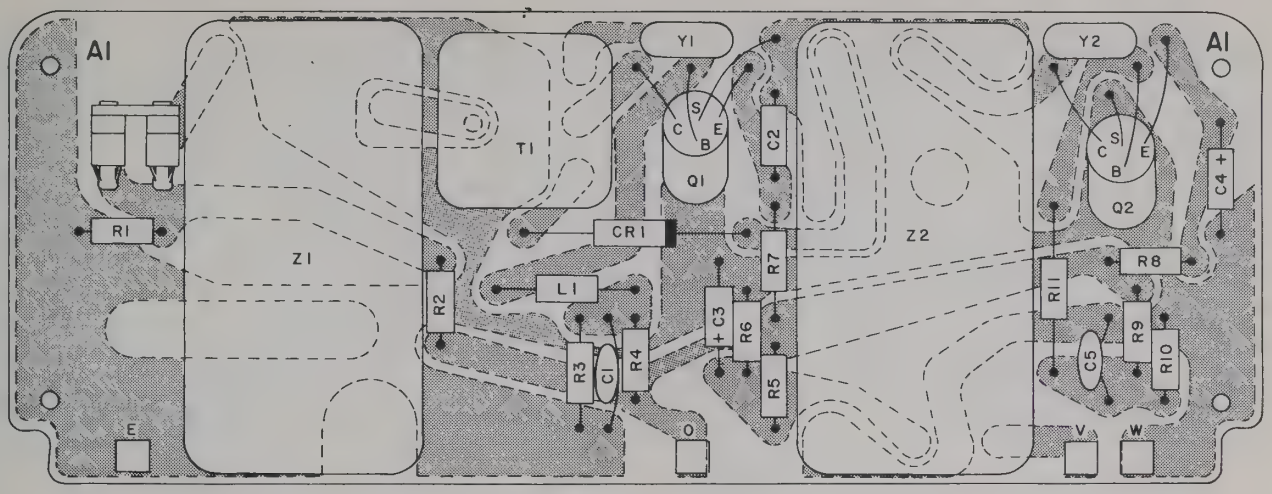
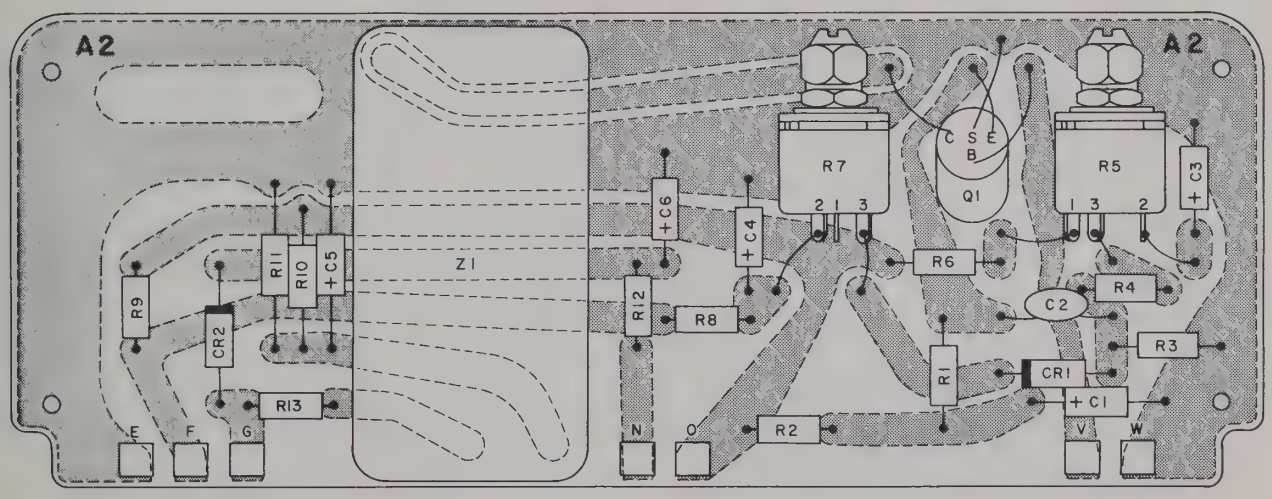
Figure 6–4. Sensitivity Control Module A2, Wiring Diagram



NOTES:
1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE MODULE DESIGNATION, A1; FOR EXAMPLE, A1C5.
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.
3. FOR CHASSIS WIRING DIAGRAM, SEE FIGURE 6-2.
4. SHADED AREA DENOTES UNETCHED COPPER ON OPPOSITE SIDE OF BOARD.

22497E(TP)

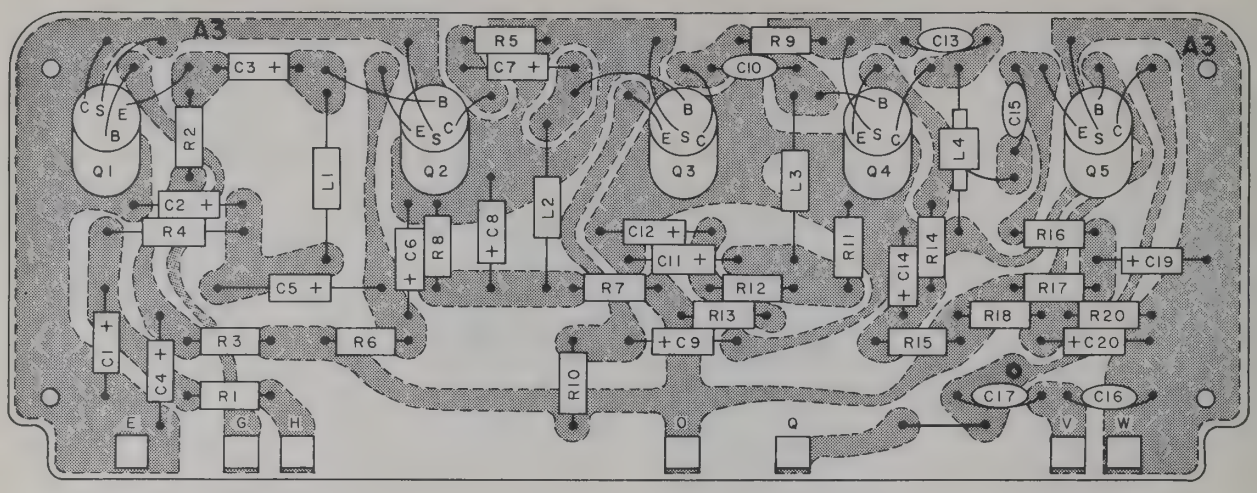
Figure 6–3. R-f Module A1, Wiring Diagram



NOTES:
1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE MODULE DESIGNATION, A2; FOR EXAMPLE, A2C6.
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.
3. FOR CHASSIS WIRING DIAGRAM, SEE FIGURE 6-2.
4. UNMARKED WIRES ARE NO. 24 AWG BARE, SOLID, TINNED COPPER.
5. SHADED AREA DENOTES UNETCHED COPPER ON OPPOSITE SIDE OF BOARD.

22496C(TP)

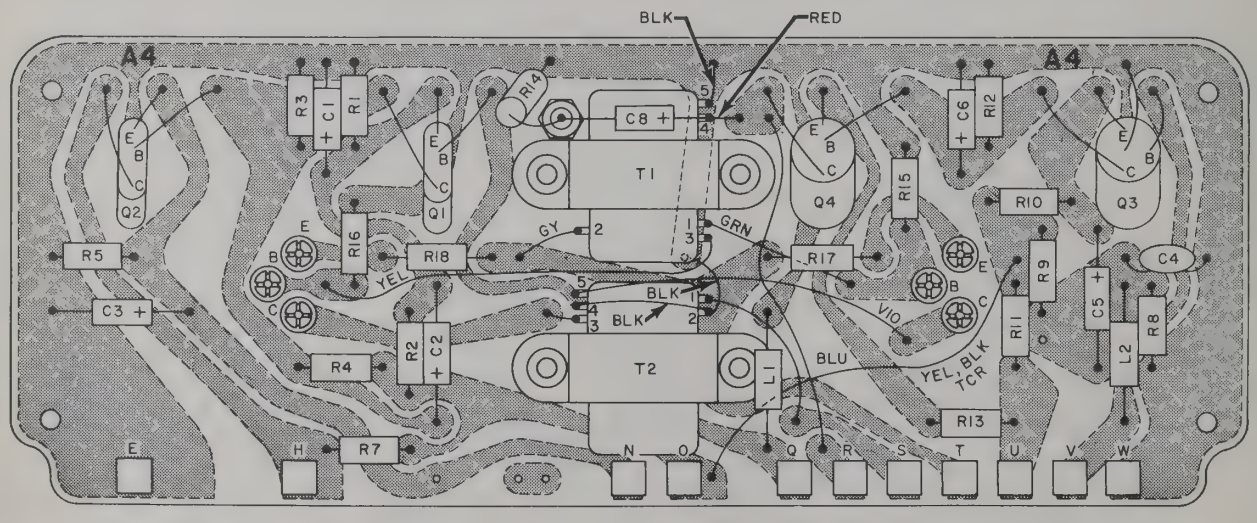
Figure 6–4. Sensitivity Control Module A2, Wiring Diagram



NOTES:
1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE MODULE DESIGNATION, A3; FOR EXAMPLE, A3C20.
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.
3. FOR CHASSIS WIRING DIAGRAM, SEE FIGURE 6-2.
4. SHADED AREA DENOTES UNETCHED COPPER ON OPPOSITE SIDE OF BOARD.

22503D(TP)

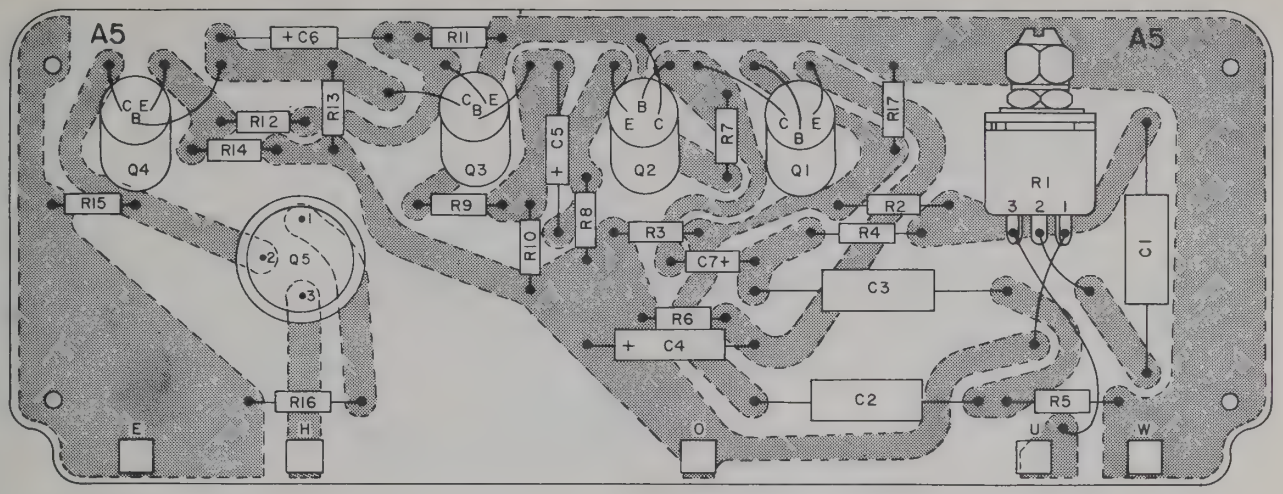
Figure 6–5. I-f Module A3, Wiring Diagram



NOTES:
1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE MODULE DESIGNATION, A4; FOR EXAMPLE, A4C8.
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.
3. FOR CHASSIS WIRING DIAGRAM, SEE FIGURE 6-2.
4. WIRES MARKED WITH COLOR NOTE ARE NO. 24 AWG STRANDED COPPER, TEFLON INSULATED.
5. SHADED AREA DENOTES UNETCHED COPPER ON OPPOSITE SIDE OF BOARD.

22504C(TP)

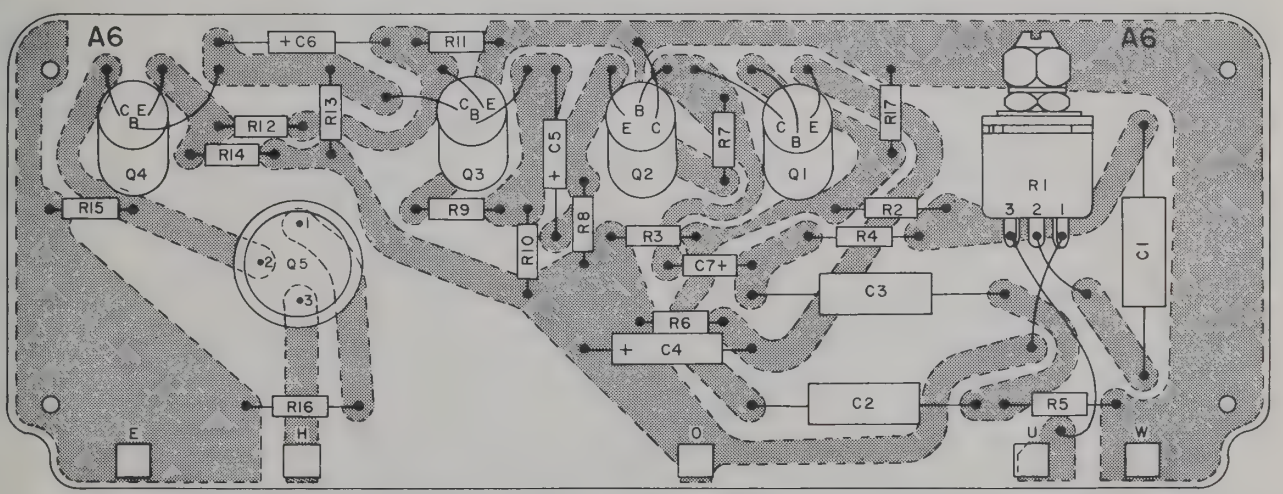
Figure 6–6. Af-Agc Module A4, Wiring Diagram



NOTES:
1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE MODULE DESIGNATION, A5; FOR EXAMPLE, A5C7.
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.
3. FOR CHASSIS WIRING DIAGRAM, SEE FIGURE 6-2.
4. WIRES MARKED WITH COLOR NOTE ARE NO. 24 AWG STRANDED COPPER, TEFLON INSULATED. UNMARKED WIRES ARE NO. 24 AWG SOLID, TINNED COPPER.
5. SHADED AREA DENOTES UNETCHED COPPER ON OPPOSITE SIDE OF BOARD.

22379C(TP)

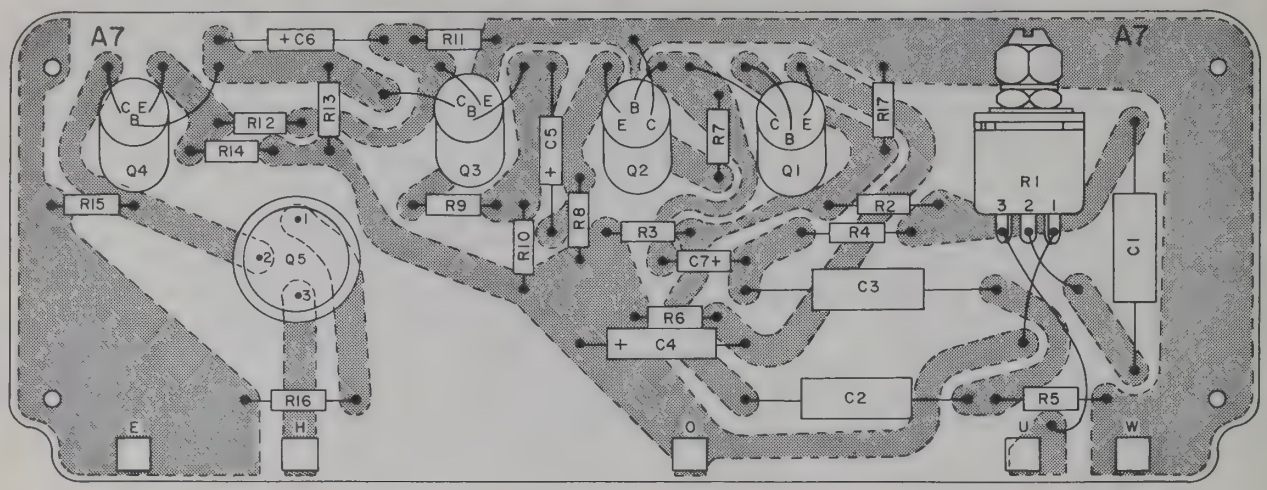
Figure 6–7. 400-cps Lamp Module A5, Wiring Diagram



NOTES:
1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE MODULE DESIGNATION, A6; FOR EXAMPLE, A6C7.
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.
3. FOR CHASSIS WIRING DIAGRAM, SEE FIGURE 6-2.
4. WIRES MARKED WITH COLOR NOTE ARE NO. 24 AWG STRANDED COPPER, TEFLON INSULATED. UNMARKED WIRES ARE NO. 24 AWG SOLID, TINNED COPPER.
5. SHADED AREA DENOTES UNETCHED COPPER ON OPPOSITE SIDE OF BOARD.

22380C(TP)

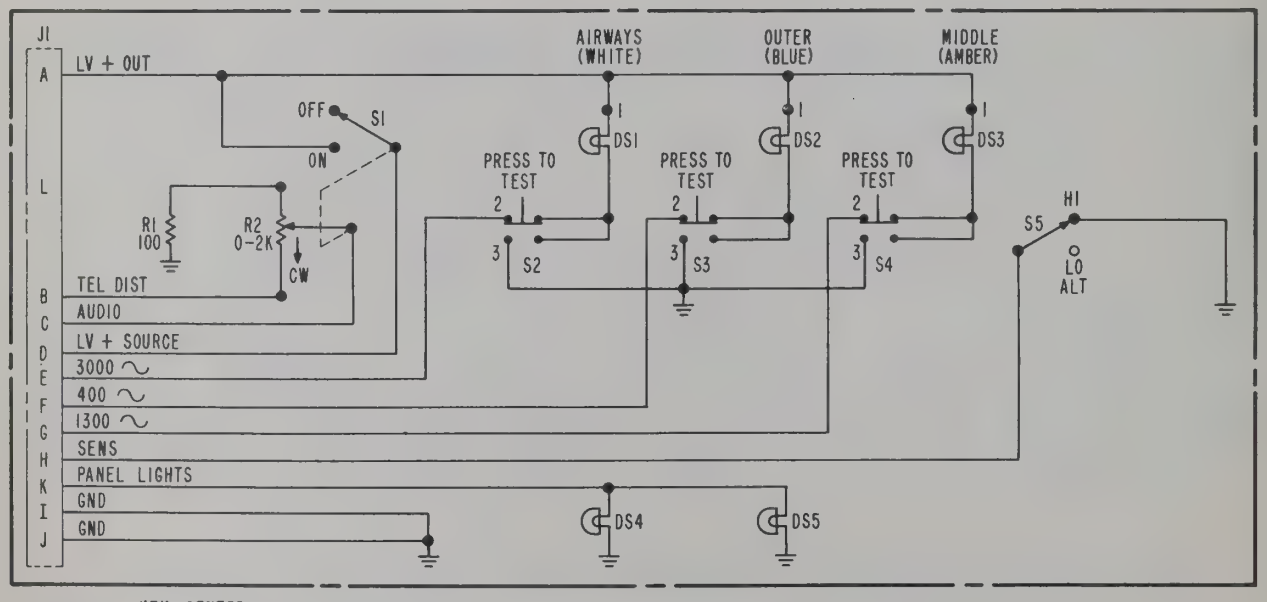
Figure 6–8. 1300-cps Lamp Module A6, Wiring Diagram

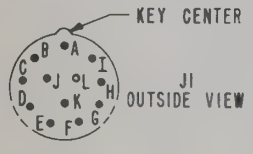


NOTES:
1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE MODULE DESIGNATION, A7; FOR EXAMPLE, A7C7.
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.
3. FOR CHASSIS WIRING DIAGRAM, SEE FIGURE 6-2.
4. WIRES MARKED WITH COLOR NOTE ARE NO. 24 AWG STRANDED COPPER, TEFLON INSULATED. UNMARKED WIRES ARE NO. 24 AWG SOLID, TINNED COPPER.
5. SHADED AREA DENOTES UNETCHED COPPER ON OPPOSITE SIDE OF BOARD

22381D(TP)

Figure 6–9. 3000-cps Lamp Module A7, Wiring Diagram

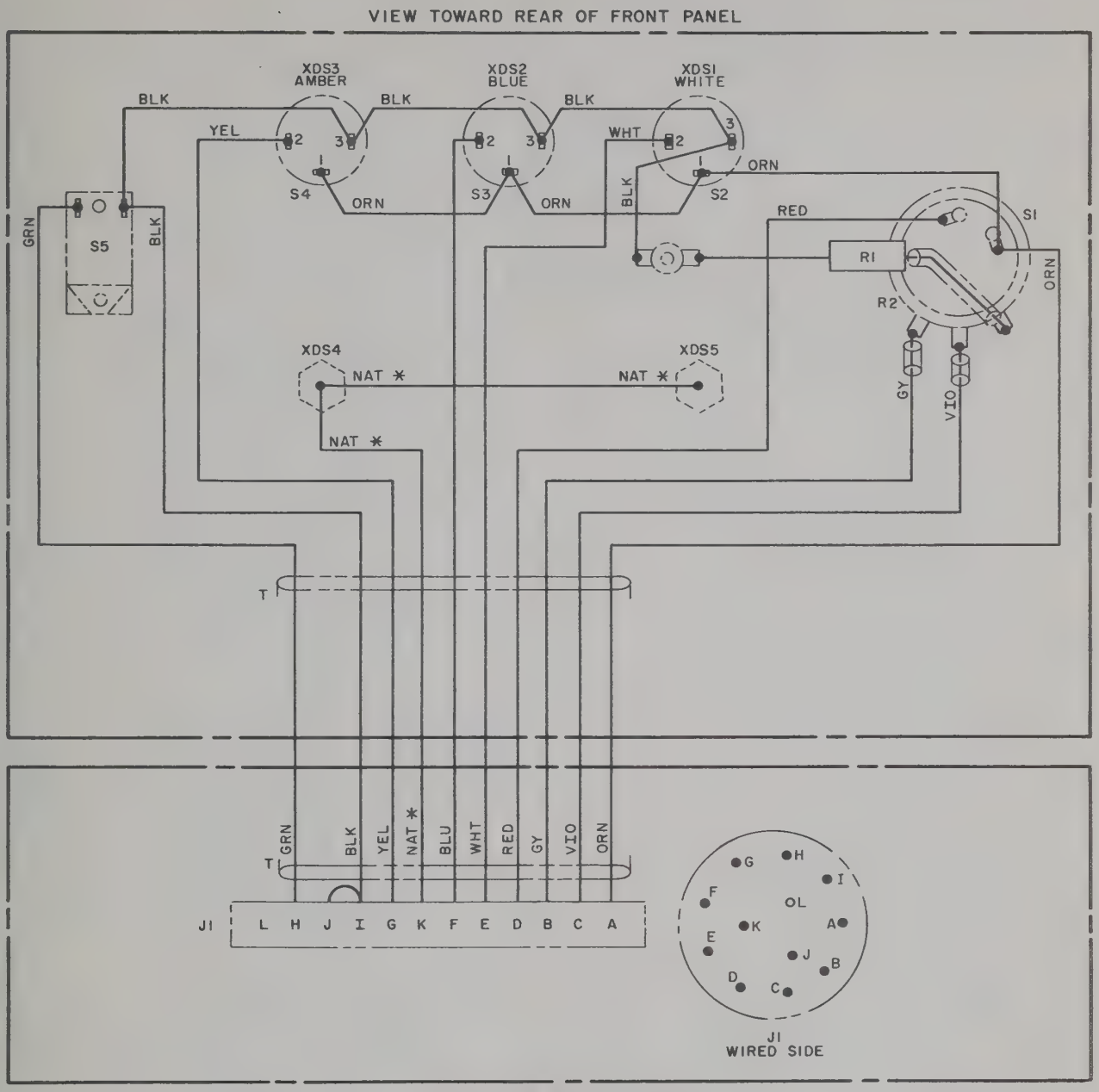




NOTES:
1. FOR WIRING DIAGRAM, SEE FIGURE 6-11.
2. RESISTANCE VALUES ARE IN OHMS; MULTIPLER K=1000.

22362A(TP)

Figure 6–10. C-83A Control Unit, Schematic Diagram



NOTES:

1. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-10.
2. RESISTANCE VALUES ARE IN OHMS; MULTIPLIER K=1000.
3. WIRES MARKED WITH COLOR NOTE ARE NO. 22 STRANDED COPPER, TEFLON INSULATED.
4. WIRES MARKED WITH COLOR NOTE AND AN ASTERISK (*) ARE NO. 20 STRANDED COPPER, TEFLON INSULATED.
5. UNMARKED WIRE IS NO. 22 SOLID, BARE, TINNED COPPER.
6. VINYLITE TUBING (0.258 INCH DIA.) INSTALLED OVER GROUP OF WIRES MARKED "T."

22361A(TP)

Figure 6–11. C-83A Control Unit, Wiring Diagram

SECTION VII

PARTS LIST

MANUFACTURERS' CODES

Code	Name and Address
AB	Allen-Bradley Co. Milwaukee, Wisconsin
AMP	Amphenol-Borg Electronics Corp. Chicago, Illinois
CLD	Cornell-Dubilier Electric Corp. South Plainfield, New Jersey
CUT	Cutler-Hammer Milwaukee, Wisconsin
DABU	Dale Products, Inc. Columbus, Nebraska
DECN	Delevan Electronics Corp. East Aurora, New York
DLC	Dialight Corp. Brooklyn, New York
EMM	Electro Motive Mfg. Co. Willimantic, Connecticut
GE	General Electric Co. Schenectady, New York
GMC	Grimes Manufacturing Co. Urbana, Ohio
IPC	Industrial Products Co. Division Amphenol-Borg Electronics Corp. Danbury, Connecticut
JFE	Jeffers Electronics Corp. St. Mary's, Pennsylvania
PK	Parker-Kalon Division General American Transportation Corp. Clifton, New Jersey
SH	Shakeproof Division Illinois Tool Works Elgin, Illinois
SLE	Sylvania Electric Products, Inc. Emporium, Pennsylvania
SPR	Sprague Electric Co. North Adams, Massachusetts
TI	Texas Instruments, Inc. Semiconductor-Components Division Houston, Texas
UNT	United Transformer Co. New York, New York

Reference Designation[1]	Description	ARC Part No.	Manufacturer & Part No.
	A1, R-F MODULE ASSEMBLY, ARC-22462		
C1	CAPACITOR, Fixed, ceramic, 0.01 μf +80 -20 per cent, 500 vdcw	8627-9103	
C2	CAPACITOR, Fixed, same as C1		
C3	CAPACITOR, Fixed, electrolytic, 1 μf ±20 per cent, 35 vdcw	21485-9101	SPR 150D105X0035A2
C4	CAPACITOR, Fixed, same as C3		
C5	CAPACITOR, Fixed, ceramic 0.015 μf +80 -20 per cent, 500 vdcw	8627-9153	
CR1	SEMICONDUCTOR DEVICE, Diode, type 1N82A	16964	
L1	CHOKE, RF, 6.8 μh ±10 per cent	8877-9681	JFE 10102-628
P1	JUMPER ASSEMBLY	22137	
Q1	TRANSISTOR, Type 2N384	22636	
Q2	TRANSISTOR, Type 2N274	22541	
R1	RESISTOR, Fixed, comp, 100 ohms ±10 per cent, 1/4w	200-0101	AB CB1011
R2	RESISTOR, Fixed, comp, 6800 ohms ±10 per cent, 1/4w	200-0682	AB CB6821
R3	RESISTOR, Fixed, comp, 2200 ohms ±10 per cent, 1/4w	200-0222	AB CB2221
R4	RESISTOR, Fixed, comp, 330 ohms ±10 per cent, 1/4w	200-0331	AB CB3311
R5	RESISTOR, Fixed, comp, 1000 ohms ±10 per cent, 1/4w	200-0102	AB CB1021
R6	RESISTOR, Fixed, same as R5		
R7	RESISTOR, Fixed, comp, 470 ohms ±10 per cent, 1/4w	200-0471	AB CB4711
R8	RESISTOR, Fixed, same as R5		
R9	RESISTOR, Fixed, same as R7		
R10	RESISTOR, Fixed, comp, 4700 ohms ±10 per cent, 1/4w	200-0472	AB CB4721
R11	RESISTOR, Fixed, comp, 47 ohms ±10 per cent, 1/4w	200-0470	AB CB4701
T1	TRANSFORMER, Oscillator	22478	
Y1	CRYSTAL, Quartz, 63.5 mc	19658-6350	
Y2	CRYSTAL, Quartz, 9.8 mc	19657-0980	
Z1	FILTER ASSEMBLY	22549	
Z2	FILTER ASSEMBLY	22460	
	A2, MIXER MODULE ASSEMBLY, ARC-22463		
C1	CAPACITOR, Fixed, electrolytic, 1 μf ±20 per cent, 35 vdcw	21485-9101	SPR 150D105X0035A2
C2	CAPACITOR, Fixed, mica, 1000 μμf ±5 per cent, 500 vdcw	8908-0102	EMM VTDM-19-102
C3	CAPACITOR, Fixed, same as C1		
C4	CAPACITOR, Fixed, same as C1		
C5	CAPACITOR, Fixed, electrolytic, 10 μf ±20 per cent, 20 vdcw	8914-0100	SPR 150D106X0020B2
C6	CAPACITOR, Fixed, same as C1		
CR1	SEMICONDUCTOR DEVICE, Diode, type 1N462	17633	

[1]Reference designations are abbreviated; for complete identification, prefix with applicable assembly designation.

Reference Designation[1]	Description	ARC Part No.	Manufacturer & Part No.
	A2, MIXER MODULE ASSEMBLY, ARC-22463 - Continued		
CR2	SEMICONDUCTOR DEVICE, Diode, same as CR1		
Q1	TRANSISTOR, Type 2N274	22541	
R1	RESISTOR, Fixed, comp, 2200 ohms ±10 per cent, 1/4w	200-0222	AB CB2221
R2	RESISTOR, Fixed, comp, 1000 ohms ±10 per cent, 1/4w	200-0102	AB CB1021
R3	RESISTOR, Fixed, comp, 47,000 ohms ±10 per cent, 1/4w	200-0473	AB CB4731
R4	RESISTOR, Fixed, comp, 47 ohms ±10 per cent, 1/4w	200-0470	AB CB4701
R5	RESISTOR, Variable, comp, 1000 ohms ±20 per cent, 0.33w	8915-0102	AB GLU1022SD3028L
R6	RESISTOR, Fixed, comp, 3300 ohms ±10 per cent, 1/4w	200-0332	AB CB3321
R7	RESISTOR, Variable, same as R5		
R8	RESISTOR, Fixed, same as R2		
R9	RESISTOR Fixed, same as R1		
R10	RESISTOR, Fixed, comp, 1500 ohms ±10 per cent, 1/4w	200-0152	AB CB1521
R11	RESISTOR, Fixed, comp, 1200 ohms ±10 per cent, 1/4w	200-0122	AB CB1221
R12	RESISTOR, Fixed, comp, 100 ohms ±10 per cent, 1/4w	200-0101	AB CB1011
R13	RESISTOR, Fixed, same as R1		
Z1	FILTER ASSEMBLY	22461	
	A3, I-F MODULE ASSEMBLY, ARC-22464		
C1	CAPACITOR, Fixed, electrolytic, 1 μf ±20 per cent, 35 vdcw	21485-9101	SPR 150D105X0035A2
C2	CAPACITOR, Fixed, same as C1		
C3	CAPACITOR, Fixed, same as C1		
C4	CAPACITOR, Fixed, same as C1		
C5	CAPACITOR, Fixed, electrolytic, 60 μf ±20 per cent, 6 vdcw	8918-0600	SPR 150D606X0006B1
C6	CAPACITOR, Fixed, same as C1		
C7	CAPACITOR, Fixed, same as C1		
C8	CAPACITOR, Fixed, same as C1		
C9	CAPACITOR, Fixed, same as C1		
C10	CAPACITOR, Fixed, mica, 68 μμf ±5 per cent, 500 vdcw	8870-0680	EMM VTDM-15-68
C11	CAPACITOR, Fixed, same as C1		
C12	CAPACITOR, Fixed, same as C1		
C13	CAPACITOR, Fixed, same as C10		
C14	CAPACITOR, Fixed, same as C1		
C15	CAPACITOR, Fixed, ceramic, 0.01 μf +80 -20 per cent, 500 vdcw	8627-9103	
C16	CAPACITOR, Fixed, mica, 470 μμf ±5 per cent, 500 vdcw	8908-0471	EMM VTDM-19-470
C17	CAPACITOR, Fixed, mica, 100 μμf ±5 per cent, 500 vdcw	8870-0101	EMM VTDM-19-100
C18	(Not used.)		
C19	CAPACITOR, Fixed, same as C1		
C20	CAPACITOR, Fixed, same as C1		
L1	CHOKE, RF, 68 μh ±10 per cent	8922-0680	DECN 3500-4

[1]Reference designations are abbreviated; for complete identification, prefix with applicable assembly designation.

Reference Designation[1]	Description	ARC Part No.	Manufacturer & Part No.
	A3, I-F MODULE ASSEMBLY, ARC-22464 - Continued		
L2	CHOKE, RF, same as L1		
L3	CHOKE, RF, same as L1		
L4	COIL	22373	
Q1	TRANSISTOR, Type 2N274	22541	
Q2	TRANSISTOR, Same as Q1		
Q3	TRANSISTOR, Same as Q1		
Q4	TRANSISTOR, Same as Q1		
Q5	TRANSISTOR, Same as Q1		
R1	RESISTOR, Fixed, comp, 150 ohms ±10 per cent, 1/4w	200-0151	AB CB1511
R2	RESISTOR, Fixed, comp, 680 ohms ±10 per cent, 1/4w	200-0681	AB CB6811
R3	RESISTOR, Fixed, comp, 2200 ohms ±10 per cent, 1/4w	200-0222	AB CB2221
R4	RESISTOR, Fixed, comp, 100 ohms ±10 per cent, 1/4w	200-0101	AB CB1011
R5	RESISTOR, Fixed, comp, 220 ohms ±10 per cent, 1/4w	200-0221	AB CB2211
R6	RESISTOR, Fixed, comp, 3300 ohms ±10 per cent, 1/4w	200-0332	AB CB3321
R7	RESISTOR, Fixed, comp, 470 ohms ±10 per cent, 1/4w	200-0471	AB CB4711
R8	RESISTOR, Fixed, same as R7		
R9	RESISTOR, Fixed, comp, value between 47 and 1000 ohms selected at time of final adjustment	200- [2]	AB CB
R10	RESISTOR, Fixed, same as R6		
R11	RESISTOR, Fixed, comp, 4700 ohms ±10 per cent, 1/4w	200-0472	AB CB4721
R12	RESISTOR, Fixed, same as R5		
R13	RESISTOR, Fixed, same as R5		
R14	RESISTOR, Fixed, same as R1		
R15	RESISTOR, Fixed, comp, 1000 ohms ±10 per cent, 1/4w	200-0102	AB CB1021
R16	RESISTOR, Fixed, same as R5		
R17	RESISTOR, Fixed, same as R5		
R18	RESISTOR, Fixed, same as R5		
R19	(Not used.)		
R20	RESISTOR, Fixed, same as R3		
	A4, AUDIO AND AGC MODULE ASSEMBLY, ARC-22465		
C1	CAPACITOR, Fixed, electrolytic, 60 μf ±20 per cent, 6 vdcw	8918-0600	SPR 150D606X0006B1
C2	CAPACITOR, Fixed, same as C1		
C3	CAPACITOR, Fixed, same as C1		
C4	CAPACITOR, Fixed, ceramic, 0.01 μf +80 -20 per cent, 500 vdcw	8627-9103	
C5	CAPACITOR, Fixed, same as C1		
C6	CAPACITOR, Fixed, electrolytic, 0.047 μf ±20 per cent, 35 vdcw	21485-9473	SPR 150D473X0035A2
C7	(Not used.)		
C8	CAPACITOR, Fixed, electrolytic, 1 μf ±20 per cent, 35 vdcw	21485-9101	SPR 150D105X0035A2

[1] Reference designations are abbreviated; for complete identification, prefix with applicable assembly designation.
[2] To complete part number, add resistance value in ohms.

Reference Designation[1]	Description	ARC Part No.	Manufacturer & Part No.
	A4, AUDIO AND AGC MODULE ASSEMBLY, ARC-22465 - Continued		
L1	CHOKE, RF, 68 μh ±10 per cent	8922-0680	DECN 3500-04
L2	CHOKE, RF, 150 μh ±10 per cent	8922-0151	DECN 3500-12
Q1	TRANSISTOR	20638	TI 904
Q2	TRANSISTOR, Same as Q1		
Q3	TRANSISTOR, Type 2N274	22541	
Q4	TRANSISTOR, Type 2N270	22635	
Q5	TRANSISTOR, Type 2N1183A	8984-0002	
Q6	TRANSISTOR, Same as Q5		
R1	RESISTOR, Fixed, comp, 100 ohms ±10 per cent, 1/4w	200-0101	AB CB1011
R2	RESISTOR, Fixed, comp, 10,000 ohms ±10 per cent, 1/4w	200-0103	AB CB1031
R3	RESISTOR, Fixed, comp, 22,000 ohms ±10 per cent, 1/4w	200-0223	AB CB2231
R4	RESISTOR, Fixed, same as R2		
R5	RESISTOR, Fixed, comp, 2200 ohms ±10 per cent, 1/4w	200-0222	AB CB2221
R6	(Not used.)		
R7	RESISTOR, Fixed, same as R5		
R8	RESISTOR, Fixed, comp, 4700 ohms ±10 per cent, 1/4w	200-0472	AB CB4721
R9	RESISTOR, Fixed, comp, 470 ohms ±10 per cent, 1/4w	200-0471	AB CB4711
R10	RESISTOR, Fixed, same as R9		
R11	RESISTOR, Fixed, same as R1		
R12	RESISTOR, Fixed, comp, 3300 ohms ±10 per cent, 1/4w	200-0332	AB CB3321
R13	RESISTOR, Fixed, same as R1		
R14	RESISTOR, Fixed, same as R9		
R15	RESISTOR, Fixed, same as R12		
R16	RESISTOR, Fixed, same as R12		
R17	RESISTOR, Fixed, comp, 10 ohms ±5 per cent, 1/2w	201-0100	AB EB1005
R18	RESISTOR, Fixed, same as R17		
T1	TRANSFORMER, Driver	22494	SLE 26252
T2	TRANSFORMER, Output	23102	SLE 26251
	A5, 400-CPS LIGHT MODULE ASSEMBLY, ARC-22466		
C1	CAPACITOR, Fixed, plastic, 0.1 μf ±5 per cent, 50 vdcw	8802	CLD TWMA1P1-5-5
C2	CAPACITOR, Fixed, same as C1		
C3	CAPACITOR, Fixed, same as C1		
C4	CAPACITOR, Fixed, electrolytic, 60 μf ±20 per cent, 6 vdcw	8918-0600	SPR 150D606X0006B1
C5	CAPACITOR, Fixed, electrolytic, 10 μf ±20 per cent, 20 vdcw	8914-0100	SPR 150D106X0020B2
C6	CAPACITOR, Fixed, same as C5		

[1] Reference designations are abbreviated; for complete identification, prefix with applicable assembly designation.

Reference Designation[1]	Description	ARC Part No.	Manufacturer & Part No.
	A5, 400-CPS LIGHT MODULE ASSEMBLY, ARC-22466 - Continued		
C7	CAPACITOR, Fixed, electrolytic, 1 μf ±20 per cent, 35 vdcw	21485-9101	SPR 150D105X0035A2
Q1	TRANSISTOR, Type 2N217	22293	
Q2	TRANSISTOR, Same as Q1		
Q3	TRANSISTOR, Type 2N647	22442	
Q4	TRANSISTOR, Same as Q1		
Q5	TRANSISTOR	22441	
R1	RESISTOR, Variable, comp, 100 ohms ±20 per cent, 0.33w	8915-0101	AB GLU1012SD3028L
R2	RESISTOR, Fixed, comp, 6800 ohms ±5 per cent, 1/2w	201-0682	AB EB6825
R3	RESISTOR, Fixed, comp, 1000 ohms ±10 per cent, 1/4w	200-0102	AB CB1021
R4	RESISTOR, Fixed, same as R2		
R5	RESISTOR, Fixed, comp, 1200 ohms ±5 per cent, 1/2w	201-0122	AB EB1225
R6	RESISTOR, Fixed, same as R3		
R7	RESISTOR, Fixed, comp, 6800 ohms ±10 per cent, 1/4w	200-0682	AB CB6825
R8	RESISTOR, Fixed, same as R3		
R9	RESISTOR, Fixed, comp, 510 ohms ±10 per cent, 1/4w	200-0511	AB CB5111
R10	RESISTOR, Fixed, same as R7		
R11	RESISTOR, Temperature sensitive, 150 ohms ±10 per cent, 1/8w	8944-0151	TI TM1/8-151K
R12	RESISTOR, Fixed, comp, 1200 ohms ±10 per cent, 1/4w	200-0122	AB CB1221
R13	RESISTOR, Fixed, comp, 2200 ohms ±10 per cent, 1/4w	200-0222	AB CB2221
R14	RESISTOR, Fixed, comp, 220 ohms ±5 per cent, 1/2w	201-0221	AB EB2215
R15	RESISTOR, Fixed, comp, 100 ohms ±10 per cent, 1/4w	200-0101	AB CB1011
R16	RESISTOR, Fixed, comp, 10 ohms ±5 per cent, 1/2w	201-0100	AB EB1005
R17	RESISTOR, Fixed, comp, 10,000 ohms ±10 per cent, 1/4w	200-0103	AB CB1031
	A6, 1300-CPS LIGHT MODULE ASSEMBLY, ARC-22467		
C1	CAPACITOR, Fixed, plastic, 0.022 μf ±5 per cent, 200 vdcw	8804	CLD TWMA4S22-5-5
C2	CAPACITOR, Fixed, same as C1		
C3	CAPACITOR, Fixed, same as C1		
C4	CAPACITOR, Fixed, electrolytic, 60 μf ±20 per cent, 6 vdcw	8918-0600	SPR 150D606X0006B1
C5	CAPACITOR, Fixed, electrolytic, 1 μf ±20 per cent, 35 vdcw	21485-9101	SPR 150D105X0035A2
C6	CAPACITOR, Fixed, same as C5		
C7	CAPACITOR, Fixed, same as C5		
Q1	TRANSISTOR, Type 2N217	22293	
Q2	TRANSISTOR, Same as Q1		
Q3	TRANSISTOR, Type 2N647	22442	
Q4	TRANSISTOR, Same as Q1		
Q5	TRANSISTOR	22441	

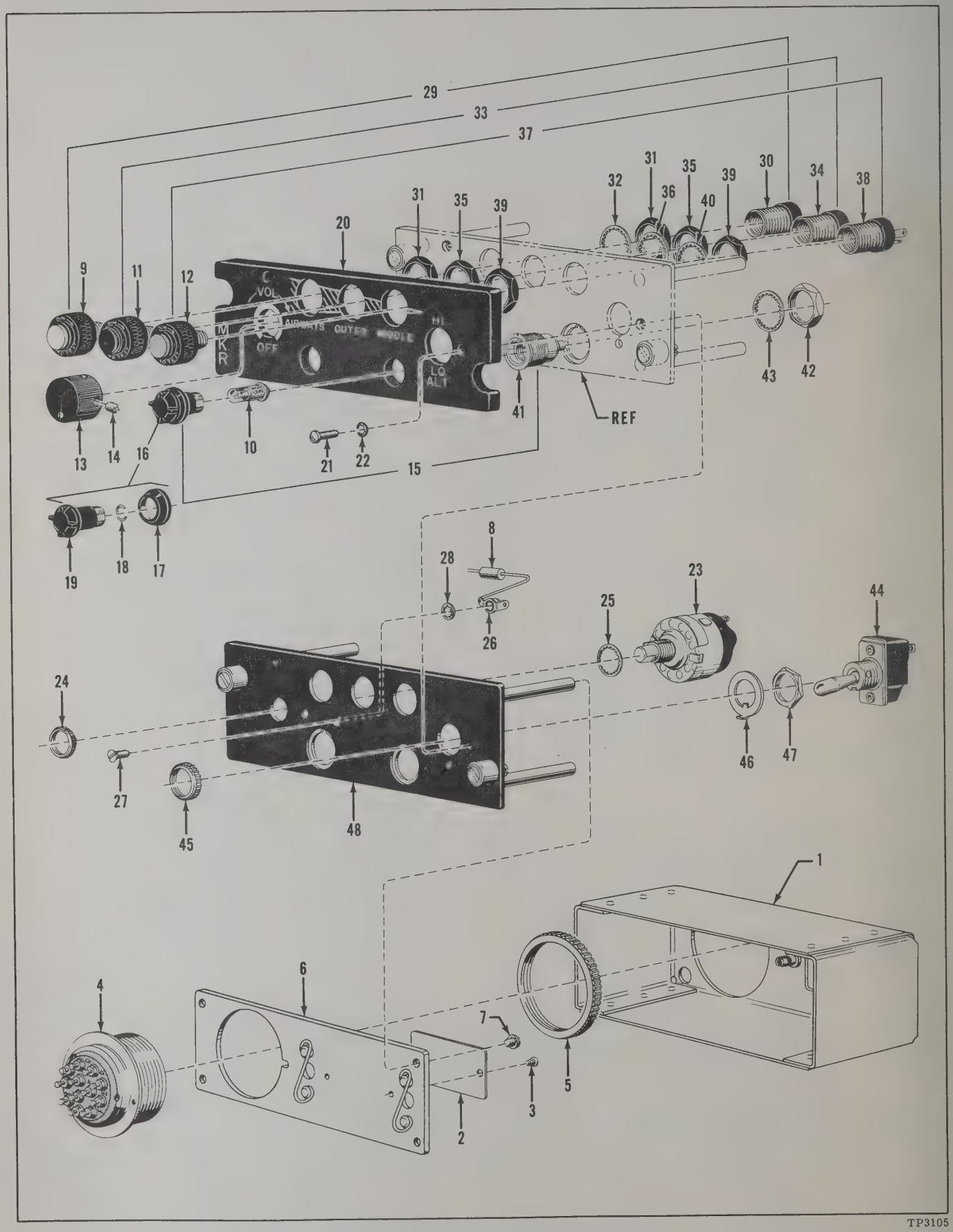
[1] Reference designations are abbreviated; for complete identification, prefix with applicable assembly designation.

Reference Designation[1]	Description	ARC Part No.	Manufacturer & Part No.
	A6, 1300-CPS LIGHT MODULE ASSEMBLY, ARC-22467 - Continued		
R1	RESISTOR, Variable, comp, 100 ohms ±20 per cent, 0.33w	8915-0101	AB GLU1012SD3028L
R2	RESISTOR, Fixed, comp, 11000 ohms ±5 per cent, 1/2w	201-0113	AB EB1135
R3	RESISTOR, Fixed, comp, 1000 ohms ±10 per cent, 1/4w	200-0102	AB CB1021
R4	RESISTOR, Fixed, same as R2		
R5	RESISTOR, Fixed, comp, 1300 ohms ±5 per cent, 1/2w	201-0132	AB EB1325
R6	RESISTOR, Fixed, same as R3		
R7	RESISTOR, Fixed, comp, 6800 ohms ±10 per cent, 1/4w	200-0682	AB CB6821
R8	RESISTOR, Fixed, same as R3		
R9	RESISTOR, Fixed, comp, 510 ohms ±5 per cent, 1/4w	341-0511	AB CB5115
R10	RESISTOR, Fixed, same as R7		
R11	RESISTOR, Temperature sensitive, 150 ohms ±10 per cent, 1/8w	8944-0151	TI TM1/8-151K
R12	RESISTOR, Fixed, comp, 1200 ohms ±10 per cent, 1/4w	200-0122	AB CB1221
R13	RESISTOR, Fixed, comp, 2200 ohms ±10 per cent, 1/4w	200-0222	AB CB2221
R14	RESISTOR, Fixed, comp, 220 ohms ±5 per cent, 1/2w	201-0221	AB EB2215
R15	RESISTOR, Fixed, comp, 100 ohms ±10 per cent, 1/4w	200-0101	AB CB1011
R16	RESISTOR, Fixed, comp, 10 ohms ±5 per cent, 1/2w	201-0100	AB EB1005
R17	RESISTOR, Fixed, comp, 10,000 ohms ±10 per cent, 1/4w	200-0103	AB CB1031
	A7, 3000-CPS LIGHT MODULE ASSEMBLY, ARC-22468		
C1	CAPACITOR, Fixed, paper, 0.01 μf ±5 per cent, 400 vdcw	8907-9103	SPR 196P10354S4
C2	CAPACITOR, Fixed, same as C1		
C3	CAPACITOR, Fixed, same as C1		
C4	CAPACITOR, Fixed, electrolytic, 60 μf ±20 per cent, 6 vdcw	8918-0600	SPR 150D606X0006B1
C5	CAPACITOR, Fixed, electrolytic, 1 μf ±20 per cent, 35 vdcw	21485-9101	SPR 150D105X0035A2
C6	CAPACITOR, Fixed, same as C5		
C7	CAPACITOR, Fixed, same as C5		
Q1	TRANSISTOR, Type 2N217	22293	
Q2	TRANSISTOR, Same as Q1		
Q3	TRANSISTOR, Type 2N647	22442	
Q4	TRANSISTOR, Same as Q1		
Q5	TRANSISTOR	22441	
R1	RESISTOR, Variable, comp, 100 ohms ±20 per cent, 0.33w	8915-0101	AB GLU1012SD3028L
R2	RESISTOR, Fixed, comp, 12,000 ohms ±5 per cent, 1/2w	201-0123	AB EB1235
R3	RESISTOR, Fixed, comp, 1000 ohms ±10 per cent, 1/4w	200-0102	AB CB1021
R4	RESISTOR, Fixed, same as R2		
R5	RESISTOR, Fixed, comp, 680 ohms ±5 per cent, 1/2w	201-0681	AB EB6815

[1] Reference designations are abbreviated; for complete identification, prefix with applicable assembly designation.

Reference Designation[1]	Description	ARC Part No.	Manufacturer & Part No.
A7, 3000-CPS LIGHT MODULE ASSEMBLY, ARC-22468 - Continued			
R6	RESISTOR, Fixed, same as R3		
R7	RESISTOR, Fixed, comp, 6800 ohms ±10 per cent, 1/4w	200-0682	AB CB6821
R8	RESISTOR, Fixed, same as R3		
R9	RESISTOR, Fixed, comp, 510 ohms ±5 per cent, 1/4w	341-0511	AB CB5115
R10	RESISTOR, Fixed, same as R7		
R11	RESISTOR, Temperature sensitive, 150 ohms ±10 per cent, 1/8w	8944-0151	TI TM1/8-151K
R12	RESISTOR, Fixed, comp, 1200 ohms ±10 per cent, 1/4w	200-0122	AB CB1221
R13	RESISTOR, Fixed, comp, 2200 ohms ±10 per cent, 1/4w	200-0222	AB CB2221
R14	RESISTOR, Fixed, comp, 220 ohms ±5 per cent, 1/2w	201-0221	AB EB2215
R15	RESISTOR, Fixed, comp, 100 ohms ±10 per cent, 1/4w	200-0101	AB CB1011
R16	RESISTOR, Fixed, comp, 10 ohms ±5 per cent, 1/2w	201-0100	AB EB1005
R17	RESISTOR, Fixed, comp, 10,000 ohms ±10 per cent, 1/4w	200-0103	AB CB1031
A8, MAIN CHASSIS ASSEMBLY			
C1	CAPACITOR, Fixed, electrolytic, 150 μf ±20 per cent, 15 vdcw	8920-0151	SPR 150D157X0015S
C2	CAPACITOR, Fixed, ceramic, 0.01 μf +80 -20 per cent, 500 vdcw	8627-9103	
C3	CAPACITOR, Fixed, same as C2		
C4	CAPACITOR, Fixed, same as C2		
C5	CAPACITOR, Fixed, electrolytic, 250 μf +100 -10 per cent, 12 vdcw	24447-0251	SPR 30D157
CR1	SEMICONDUCTOR DEVICE, Diode, type 1N1351A	8923-0100	
J1	CONNECTOR, Receptacle, electrical	21768	AMP 94-21320
J2	CONNECTOR, Receptacle, electrical	11338	IPC 87000
L1	CHOKE, RF, 47 μh ±10 per cent	8926-0470	DECN 2890-36
R1	RESISTOR, Fixed, ww, 50 ohms ±3 per cent, 25w	340-0002	DABU RH-25-50
R2	RESISTOR, Fixed, comp, 12 ohms ±5 per cent, 2w	203-0120	AB HB1205
R3	RESISTOR, Variable, comp, 2500 ohms ±20 per cent, 0.33w	8915-0252	AB GLU2522SD3028L
W1	CABLE ASSEMBLY	20469	

[1] Reference designations are abbreviated; for complete identification, prefix with applicable assembly designation.



C-83A Control Unit, Exploded View

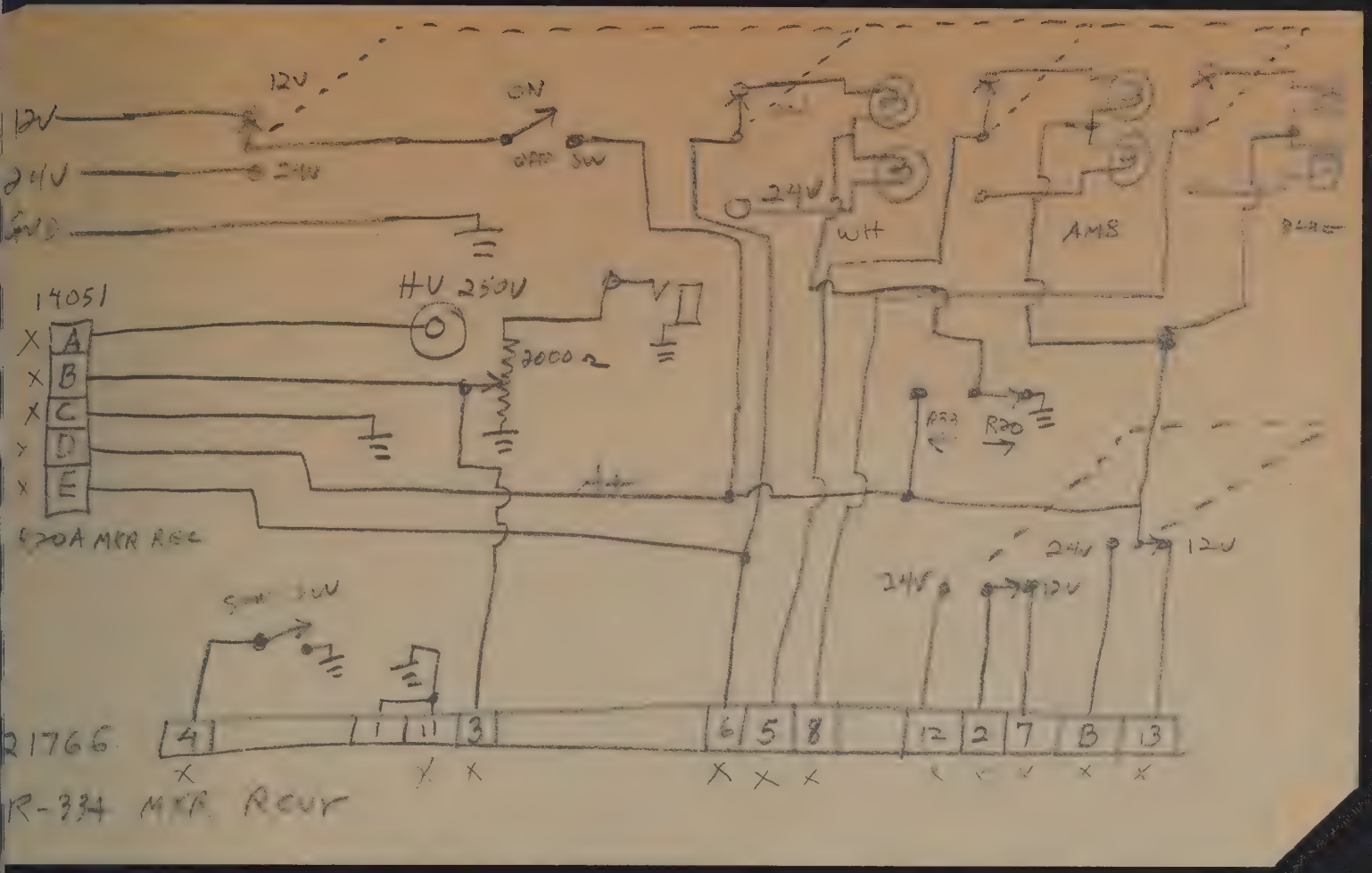

12V
ON
OFF SW
24V
WHT
AMB
BLK
14051
HV 250V
2000Ω
A
B
C
D
E
720A MKR AGC
R33
R30
24V
12V
SW 12V
4
1
11
3
6
5
8
12
2
7
B
13
R1766
R-334 MKR RCVR

Figure & Index No.	ARC Part No.	1 2 3 4 5 6 Description	Units per Assy
	22360	CONTROL UNIT ASSEMBLY, ARC Type C-83A	1
1	22778	. COVER ASSEMBLY	1
2	22484	. PLATE, Identification	1
		(ATTACHING PARTS)	
3	8081	. SCREW, Tapping, rh, Phillips dr, stl, blk parkerized, No. 2 by 5/32 in. lg (PK)(Z)	2
		- - - * - - -	
4	16713	. CONNECTOR, Receptacle, electrical	1
		(ATTACHING PARTS)	
5	16720	. NUT, Knurled (supplied with item 4).	1
		- - - * - - -	
6	22775	. PLATE, Mounting.	1
		(ATTACHING PARTS)	
7	503-0016	. SCREW, Assembled washer, bind. h, brs screw, sst lockwasher, ni pl, 3-48 thd by 1/4 in. lg (SH)(SEMS)	4
		- - - * - - -	
8	201-0101	. RESISTOR, Fixed, comp, 100 ohms ±5 per cent, 1/2w (AB) . . . (EB1015)	1
9	—	. CAP, Indicator, white lens (DLC)(10850M-1A)(supplied with . . . item 29)	1
10	8622	. LAMP, Incandescent, 28V, T-1-3/4 bulb (GE)(327)(for 28V model)	5
10	8679	. LAMP, Incandescent, 14V, T-1-3/4 bulb (GE)(330)(for 14V model)	5
11	—	. CAP, Indicator, blue lens (DLC)(10850M-10A)(supplied with . . . item 32)	1
12	—	. CAP, Indicator, amber lens (DLC)(10850M-4A)(supplied with . . item 35)	1
13	16331	. KNOB	1
		(ATTACHING PARTS)	
14	306-0012	. SETSCREW, Fluted socket dr, cup point, sst, 6-32 thd by 3/16 . in. lg	2
		- - - * - - -	
15	16293	. LIGHT ASSEMBLY, Panel (GMC)(A-5890)	2
16	—	. . LAMP HOUSING ASSEMBLY (GMC)(A-5181)	2
17	—	. . . GROMMET, Panel light (GMC)(A-4846A)	2
18	—	. . . SPRING, Lamp retainer (GMC)(A-3674)	2
19	—	. . . LAMP HOUSING AND FILTER ASSEMBLY (GMC)(A-5178) .	2
20	22780	. PANEL, Printed, plastic.	1
		(ATTACHING PARTS)	
21	113-0024	. SCREW, Machine, bind. h, brs, blk oxidized, 3-48 thd by 3/8 . in. lg	2
22	10353	. WASHER, Spring tension	2
		- - - * - - -	
23	8865	. RESISTOR, Variable, comp, 2000 ohms ±10 per cent, 2.25w, . . with spst switch (AB)(JSU-2021FS-2032)	1
		(ATTACHING PARTS)	
24	4697	. NUT, Round	1
25	8540	. WASHER, Lock, ph brz, ni pl, 0.384 ID by 0.500 OD by 0.022 in. thk (SH)(1920-02)	1
		- - - * - - -	
26	14699	. TERMINAL ASSEMBLY	1
		(ATTACHING PARTS)	
27	153-0016	. SCREW, Machine, fh, brs, blk oxidized, 3-48 thd by 1/4 in. lg .	1
28	4103	. WASHER, Lock, sst, 0.105 ID by 0.220 OD by 0.025 in. thk . . (SH)(1703)	1
		- - - * - - -	
29	22231	. LIGHT, Indicator, white lens (DLC)(VM911M-1A).	1
30	—	. . HOUSING, Indicator	1
		(ATTACHING PARTS)	
31	—	. . NUT, Hexagon (supplied with item 29).	2
32	—	. . WASHER, Lock (supplied with item 29)	1
		- - - * - - -	

Figure & Index No.	ARC Part No.	1 2 3 4 5 6 Description	Units per Assy
33	22232	. LIGHT, Indicator, blue lens (DLC)(VM911M-10A)	1
34	—	. . HOUSING, Indicator.	1
		(ATTACHING PARTS)	
35	—	. . NUT, Hexagon (supplied with item 33).	2
36	—	. . WASHER, Lock (supplied with item 33)	1
		- - - * - - -	
37	19500	. LIGHT, Indicator, amber lens (DLC)(VM911M-4A)	1
38	—	. . HOUSING, Indicator.	1
		(ATTACHING PARTS)	
39	—	. . NUT, Hexagon (supplied with item 37).	2
40	—	. . WASHER, Lock (supplied with item 37)	1
		- - - * - - -	
41	—	. RETAINER, Lamp housing (p/o 15)(GMC)(A-4996)	2
		(ATTACHING PARTS)	
42	—	. NUT, Hexagon, 15/32 thd (supplied with item 15)	2
43	—	. WASHER, Lock (supplied with item 15)	2
		- - - * - - -	
44	8084	. SWITCH, Toggle, spst (CUT)(8908K142)	1
		(ATTACHING PARTS)	
45	—	. NUT, Round (CUT)(15-124)(supplied with item 41).	1
46	21103	. WASHER, Key	1
47	—	. NUT, Hexagon (CUT)(815-254)(supplied with item 41)	1
		- - - * - - -	
48	22773	. PANEL ASSEMBLY	1

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